STATE OF CALIFORNIA
The Resources Agency

Department of Water Resources

BULLETIN No. 143-4

RUSSIAN RIVER WATERSHED WATER QUALITY INVESTIGATION

MAY 1968

RONALD REAGAN
Governor
State of California

WILLIAM R. GIANELLI
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FOREWORD

Burgeoning population, increased leisure time, and changing agricultural and economic patterns in the area north of San Francisco Bay have resulted in growing quantitative and qualitative demands on the water resources of the area.

For nearly its entire length in Sonoma and Mendocino counties, the Russian River supports heavy recreational use and substantial population, yet yields good quality domestic water downstream from most of the recreational areas and population centers. This downstream supply of good quality water will continue to be available only if the quality of water in the entire Russian River watershed is protected from the possible degrading effect of upstream development.

The base-line for provision of that protection is included in this bulletin, which is the result of a two-year investigation by the Department of Water Resources, authorized by Section 229 of the Water Code.

The need for a water quality investigation of the Russian River watershed was demonstrated during various activities of the Department, including monitoring programs and smaller studies. The North Coastal Regional Water Quality Control Board and various local agencies expressed an interest in a more complete investigation.

As a result of this investigation, the Department proposes long-range surface water quality objectives for specific chemical and physical parameters and recommends that the North Coastal Regional Water Quality Control Board adopt objectives in concert with these, and establish requirements and monitoring procedures for all waste discharges to land. The Department of Water Resources also recommends that the Sonoma County Board of Supervisors in planning future waste disposal facilities, give top priority to eliminating all nutrient-bearing waste water discharges from the Russian River and its tributaries.

William R. Gianelli

William R. Gianelli, Director
Department of Water Resources
The Resources Agency
State of California

March 29, 1968

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JOHN R. TEERINK, Deputy Director

SAN FRANCISCO BAY DISTRICT

Charles A. McCullough . . . . District Engineer
Vernon Bengal . . . . . Chief, Water Supply and Quality Section

This investigation was conducted and the
report written under the supervision
of

Ralph D. Drown . . . . Senior Engineer, Water Resources
Keith G. Battleson . . . Water Resources Engineering Associate

By

Arthur L. Coe . . . . Assistant Civil Engineer

Assisted by

William R. Leonard . . . . Associate Civil Engineer
James J. Morgester . . . . Water Resources Technician II
Robert S. Ford . . . . Senior Engineering Geologist
Audrey Calder . . . . Research Writer

CALIFORNIA WATER COMMISSION

State of California
The Resources Agency
DEPARTMENT OF WATER RESOURCES

ENGINEERING CERTIFICATION

This report has been prepared under my direction as the professional engineer in direct responsible charge of the work, in accordance with the provisions of the Civil and Professional Engineers' Act of the State of California.

Irvin Bengal
Registered Civil Engineer

Registration No. C7466

Date 2 Feb 1968

ATTEST:

C. A. McCullough
District Engineer
San Francisco Bay District

Registration No. C8123

Date 2/2/68

ACKNOWLEDGMENTS

Valuable assistance was supplied during this investigation by: the Sonoma County Board of Supervisors, the Sonoma County Flood Control and Water Conservation District, the Sonoma County Public Health Service, the Sonoma County Harbor Commission, the Mendocino County Board of Supervisors, the State Department of Fish and Game, the State Department of Public Health, the North Coastal Regional Water Quality Control Board, and the United States Army Corps of Engineers.

The Department of Water Resources appreciates the help of these organizations.

ABSTRACT

The 1,485 square-mile watershed of the Russian River is located in Sonoma and Mendocino counties. Elevations range from sea level to 4,000 feet. Most of the population in the watershed is concentrated in the flat valley areas of Sonoma County.

Agriculture is the basis of the economy of the study area. Lumbering and wood products are the major manufacturing industry within the watershed. Recreation is a major source of revenue to the communities along the lower Russian River during the summer.

The Russian River supports heavy recreational use and a substantial population along nearly its entire length, yet yields good quality domestic water downstream from most of the recreational areas and population centers.

Municipal and domestic use, agriculture, and recreation are the major water uses in the watershed. Other water uses are fish propagation, waste assimilation, and industrial supply.

Biological activity in the lower Russian River, stimulated by nutrients from domestic sewage effluents, results in water quality problems of increasing magnitude. The resulting conditions tend to discourage water-oriented recreation during the summer.

The Department of Water Resources proposed long-range surface water quality objectives for specific chemical and physical parameters and recommends that the North Coastal Regional Water Quality Control Board adopt objectives in concert with these, and establish requirements and monitoring procedures for all waste discharges to land. The Department also recommends that the Sonoma County Board of Supervisors, in planning future waste disposal facilities, give top priority to eliminating all nutrient-bearing waste water discharges from the Russian River and its tributaries.

CHAPTER I. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The Russian River supports heavy recreational use and a substantial population along nearly its entire length, yet yields good quality domestic water downstream from most of the recreational areas and population centers.

The extensive use of the watershed upstream from a large diversion for domestic water supply results in a continuing vulnerability to serious water quality problems.

The drainage area of the Russian River watershed extends from the natural source of the river south of Willits in Mendocino County to the river's mouth at Jenner in Sonoma County. Headwaters of the East Fork Russian River are augmented by year-round imports of Eel River water for power generation at Potter Valley.

Most of the population in the watershed is concentrated in the valley areas of Sonoma County. Santa Rosa, the county seat of Sonoma County, is the largest population center in the watershed. The second largest population center is Ukiah, the county seat of Mendocino County.

The major sources of revenue in the watershed are agriculture, lumbering, and wood products manufacturing. During the summer months, water-oriented recreation attracts many tourists who contribute a large amount of revenue to the area.

Municipal and domestic use, agriculture, and recreation are the major water uses in the watershed. Other uses of lesser importance are fish propagation, waste assimilation, and industrial use.

The climate characteristics of the Russian River watershed generally determine the quantity and distribution of runoff. Because the mineral quality of water usually improves with increased flow, rainfall and runoff patterns affect water quality. Nearly 90 percent of the annual runoff in the watershed occurs in the five-month period from December through April. Thus, the higher flows of the best quality water occur during the wet months when many water uses, notably agriculture, are at a minimum. Therefore, construction of dams and reservoirs is a necessary means of increasing dry weather flows.

The Sonoma County Board of Supervisors is implementing a master plan for waste disposal in the Santa Rosa Valley. The master plan was proposed by M. Carleton Yoder, Consulting Engineer, in a 1962 report to the Board of Supervisors. The master plan provides for eventual elimination of all sewage-bearing waste water discharges from the Russian River and its tributaries. Some of the waste water would be discharged to the Pacific Ocean and some would be reclaimed for irrigation. The Board of Supervisors is implementing the master plan in stages. A sewage treatment plant is being completed in the Laguna area as a part of this plan.

The specific objectives of this investigation included the following:

1. Determine the present quality of water, including seasonal or other fluctuations in quality, in various reaches of the main stem and in all substantial tributaries of the Russian River.
2. Determine the present quality of ground water within the watershed.
3. Determine the sources and magnitude of present degradation of water quality within the watershed.
4. Define objectives for specific chemical and physical parameters of surface water quality.

5. Determine the minimum continuing water quality monitoring program necessary to detect future changes in the quality of waters in the Russian River watershed.

To meet the objectives of this investigation, existing publications and current data programs were studied. Information was obtained pertaining to water use, geology, surface and ground water hydrology, and water quality criteria. Present surface water quality data was obtained from both field and laboratory analyses conducted during the investigation. The Department of Water Resources' annual data program furnished most of the information on ground water quality, and field inspections plus laboratory analyses produced the required information concerning existing waste water discharges.

Conclusions

1. Surface water within the Russian River watershed is generally Class 1 (excellent to good), according to the Department of Water Resources' classification, with respect to chemical standards for irrigation.
2. Selected chemical constituents present in the surface water are generally at concentrations less than the limiting values for drinking water set by the U. S. Public Health Service.
3. Chemical analyses of Russian River water show that no significant degradation has occurred since 1951. However, waste discharges have already exceeded the assimilative capacities of some of the tributaries (Mark West Creek, Santa Rosa Creek, and Green Valley Creek) and as these discharges increase in the future they could significantly degrade the Russian River.

4. Ground water within the watershed presently is of good quality with respect to both the Department of Water Resources' irrigation water standards and the U. S. Public Health Service's drinking water standards. However, problems exist in some areas, principally in Sanel Valley, due to highly mineralized water from deep aquifers.

5. Existing problems affecting the quality of surface waters are:

   a. Springs near Vichy Springs Resort discharge water containing high concentrations of boron (118 ppm) and high percentages of sodium (81 percent) into Sulphur Creek.

   b. High concentrations of iron (up to 6.8 ppm) and manganese (up to 0.84 ppm) in some parts of the Russian River system (Russian River, York Creek, Mark West Creek, Sulphur Creek) during the summer months.

   c. High boron concentrations (up to 1.8 ppm) in Big Sulphur Creek from thermally active springs in the vicinity of The Geysers Power Plant.

   d. Increasing concentrations of coliform organisms in the Russian River during the summer months, particularly below the confluence of Mark West Creek.

   e. Domestic waste water discharges into streams in the Laguna area (Mark West Creek, Santa Rosa Creek, Green Valley Creek, and the Laguna de Santa Rosa) resulting in poor quality water with respect to both chemical and biological constituents. Apple processing waste discharges into Green Valley Creek resulting in poor quality water and severe odor problems.

   f. Growth of phytoplankton (mostly unattached algae) in the lower Russian River, due to high nutrient concentrations (nitrates and phosphates) in waste discharges. Resulting algal blooms tend to discourage water-contact sports and other water-oriented recreation.

   g. High turbidities in the Russian River and many of its tributaries caused by sand and gravel operations as well as by erosion resulting from periods of heavy runoff.

6. The most important existing water quality problem in the watershed is caused by waste water from the Santa Rosa Valley reaching the lower

Russian River. The resulting phytoplankton growths endanger the economically important water-oriented recreation in the area. High coliform counts also indicate a potential public health problem.

7. Complete implementation of the master plan for waste disposal in Santa Rosa Valley, proposed in the Yoder report, will result in a reduction of nutrient concentrations, and consequent reduction of phytoplankton growths in the lower Russian River. The extent of the problem caused by phytoplankton growths in the lower Russian River is such that some means of removing excess nutrient concentrations from the river will be necessary in the near future.

8. Resolution No. 59, adopted by the North Coastal Regional Water Quality Control Board, established objectives concerned primarily with bacterial and physical parameters of water quality in the Russian River watershed. However, the Board recognizes the need to expand these objectives to include a wider spectrum of specific water quality parameters.

9. Objectives for specific parameters of water quality should be set to protect the following beneficial water uses: municipal and domestic, agriculture, fish propagation and recreation. The objectives should also be set to maintain the excellent mineral quality of water present in most of the watershed. Proposed objectives are presented in Table 33, page 134.

10. Data from the surface water sampling program conducted by the Department of Water Resources will make possible continuing surveillance of surface water quality conditions in the watershed. In addition, it would be desirable to collect samples from the Russian River, near Healdsburg, and at Guerneville, for nutrient and phytoplankton determinations.

Recommendations

1. The North Coastal Regional Water Quality Control Board should:
    a. Adopt long-range surface water quality objectives as a part of its Resolution 59, which are in concert with those presented in this report;
    b. Establish requirements and ground water monitoring procedures for all waste discharges to land, including solid waste disposal operations, in areas of usable ground water; and
    c. Discourage the construction of small waste-treatment facilities for subdivisions and encourage the sewering of subdivisions to existing or planned municipal facilities.
2. The Sonoma County Board of Supervisors should give priority to actions which would eliminate all nutrient-bearing waste discharges from the Russian River and its tributaries in implementation of the County Master Plan for Waste Disposal.
3. The North Coastal Regional Water Quality Control Board and the County of Sonoma should explore with the Department of Water Resources means by which the minimum water quality monitoring program described in this report can be implemented.

CHAPTER II. INTRODUCTION

The paramount concern for quality of water in the Russian River watershed stems from the effect of domestic waste disposal. Further degradation in the base level quality of these waters will adversely affect the extensive water-oriented recreation industry, as well as municipal, agricultural, and other industrial users.

In this report, baseline water quality conditions are defined, water quality problems of the area are evaluated, and corrective actions are recommended.

Area of Investigation

The Russian River watershed is located in the North Coastal Hydrographic Area. The drainage area extends from the natural source of the Russian River south of Willits in Mendocino County to the mouth of the river at Jenner, in Sonoma County. Headwaters of the East Fork of the Russian River are augmented by year-round imports of Eel River water used for power generation at Potter Valley. The area of investigation is shown on Plate 1.

Within the 1,485 square-mile area of the watershed, elevations very from near sea level to about 4,000 feet with a generally steep and rugged topography. West of the drainage are, the Mendocino Range, with elevations reaching 3,000 feet, is generally heavily forested. The Mayacmas Mountains, which rise about 4,000 feet on the eastern boundary of the watershed, are not as heavily forested, but have large amounts of low brush cover.

Most of the population in the watershed is concentrated in the valley areas of Sonoma County. Santa Rosa, the county seat of Sonoma County, is the largest population center in the study area. The second largest city is Ukiah, the county seat of Mendocino County. Smaller communities are located along the entire length of the river at 15 to 20 mile intervals.

Agriculture forms the basis of the economy in the study area, but industry is growing rapidly. Major crops include prunes, hay and grain, apples and grapes. Beef cattle and poultry are both important agricultural products. Much of the valley land is irrigated with both ground and surface water used as sources.

Lumbering and wood products are the major manufacturing industry within the watershed. Food and dairy product processing, printed materials, chemical production, and fabricated metal products are other important industries in the area. Tourists are a major source of revenue to communities along the lower reach of the Russian River during the summer months.

Objectives of Investigation

The San Francisco Bay District of the Department of Water Resources has supplemented its basic network of surface, ground, and waste water sampling by more comprehensive investigations of some of the major watersheds within the District. The general objectives of these investigations were to supplement data collection with periodic watershed fact-finding studies to determine water quality trends or changes.

The Russian River supports heavy recreational use and a substantial population along nearly its entire length. Large amounts of water are diverted for domestic consumption downstream from highly populated areas and areas of heavy recreational use. Chiefly for these reasons the Russian River watershed was selected as the site of the third of these investigations. Specific objectives of this water quality investigation include:

1. Determine the present quality of water, including seasonal or other fluctuations in quality, in various reaches of the main stem and in substantial tributaries of the Russian River.
2. Determine the present quality of ground water within the watershed.
3. Determine the sources and magnitude of present degradation of water quality within the watershed.
4. Define objectives for specific chemical and physical parameters of surface water quality.
5. Determine the minimum continuing water quality monitoring program necessary to detect future changes in the quality of waters in the Russian River watershed.

Scope of Investigation

Because of the many facets of water quality involved, this was made a comprehensive investigation by soliciting the aid of several agencies representing the varied disciplines of water quality. An advisory Committee made up of state and local agencies was formed early in the planning stages of this investigation to help guide the study and to promote interagency cooperation.

Existing publications and current data programs provided much of the information on water use, geology, surface and ground water hydrology, and water quality criteria. Present surface water quality data was obtained by both field and laboratory analyses during the course of this study. The Department of Water Resources' basic data program furnished most of the data on ground water quality, and field inspections plus laboratory analyses produced the required information on existing waste discharges.

The files of interested agencies were made available to Department of Water Resources personnel and provided data on specific problem areas.

Potential Problems

Several of the existing and potential water quality problems in the Russian River watershed are rapidly becoming acute. The main stem of the river is plagued with high turbidities much of the year and is receiving constantly increasing quantities of treated waste water.

The increased pressure of recreational activities within the watershed is creating heavier demands for clear surface water. Recreational facilities must be incorporated into all new impoundment projects in the study area and care must be taken so that such facilities will not degrade the natural water quality.

Ground water reservoirs also present existing and potential water quality problems. In some areas of Sanel Valley, ground water contains boron concentrations greater than the valley's agricultural crops will tolerate. Parts of the Santa Rosa Valley produce ground water of a quality unsuitable for many uses, and there are some poor quality springs along the west side of the Mayacma Mountains.

Related Investigations and Reports

All references used during this investigation are listed in Appendix A, Bibliography. In the text, direct reference to a particular publication or report is indicated by means of a number in parentheses; for example, (1).

CHAPTER III. WATER USE

The water flowing in the Russian River system is vital to the economy of most of Sonoma County and a good portion of Mendocino County. The uses outlined in this chapter are presented in the approximate order of importance to the watershed.

Municipal and Domestic Use

Municipal and domestic water is supplied by about 80 individual water supply systems. These systems serve as few as one customer to as many as 12,000. The Sonoma County Flood Control and Water Conservation District supplies water to areas outside of the watershed.

Table 1 lists most of the water supply systems in the watershed and includes the following information, where known: water source(s), number of service connections, and treatment provided.

Sonoma County Flood Control and Water Conservation District

The largest water supply system in the Russian River watershed is operated by the Sonoma County Flood Control and Water Conservation District (SCFCWCD). Water is supplied to six distribution systems.

Coyote Dam is the key to the entire SCFCWCD system. It was constructed on the East Fork Russian River by the United States Army Corps of Engineers in 1958. Lake Mendocino, the reservoir impounded by the dam, has a controlled storage capacity of 122,500 acre-feet and a water supply yield of 60,000 acre feet per year. Controlled releases are made to the Russian River.

Water is diverted by the intake facilities known as Ranney Collectors, in the bed of the Russian River approximately 70 miles downstream from Coyote Dam and 13 miles east of Santa Rosa. The two Ranney

TABLE 1

WATER SERVICE SYSTEMS WITHIN THE RUSSIAN RIVER WATERSHED

System	Source (s) of Supply	No. of Service Connections	Treatment 1/
MENDOCINO COUNTY			
Capella County Water District	Wells	50	Cl_2
Hopland Public Utility District	Wells	150	Cl_2
Mendocino County Water Works District #1	Unknown	180	Unknown
Millview County Water District	Wells	180	Cl_2
Oak Knolls Mutual Water Company	Unknown	Unknown	Unknown
Potter Valley Irrigation District	Unknown	Unknown	Unknown
Rogina Water Company	Wells	345	Cl_2
Ukiah Municipal Water Department	Wells	3,067	Cl_2
Willow County Water District	Wells	550	Cl_2
SONOMA COUNTY			
Armstrong Valley Water Company	Wells	153	N
Belmont Terrace Mutual Water Company	Wells	70	Cl_2
Brand Water Company	Wells	32	Cl_2
Branger Mutual Water Company	Wells	60	N
Broadmoor Acres Water Company	Wells	15	Cl_2
Camp Meeker Water System Inc.	Springs	145	Unknown
Cazadero Water Company	Wells & Springs	144	N
Citizens Utilities of California	Stream	2,950	N
Cloverdale Municipal Water Department	Unknown	853	Unknown
End-o-Valley Mutual Water Company Inc.	Wells	25	N
Firerest Mutual Water Company	Wells	44	N
Fitch Mountain Water Company	Wells	Unknown	Cl_2
Geyserville Water Works	Unknown	175	Unknown
Geyserville Water Company	Wells	138	Unknown
Graton Water Works	Wells	20	Unknown
Hacienda Water Company	Wells & Stream	150	Cl_2
Healdsburg Municipal Water Department	Wells	1,752	Cl_2, F
Hiatt Mutual Water Company	Wells	2	N
Hilton Mutual Water Company	Wells	20	N
Holland Heights Mutual Water Company	Wells	88	Cl_2
Hollydale Mutual Water Company	Wells	1	Cl_2
Jaylee Heights Mutual Water Company	Wells	8	N
Jenner Water Works	Spring	89	Unknown
Kelly Mutual Water Company	Wells	37	N
Lancaster Water Supply	Wells	8	Unknown
Larkfield Water Company	Unknown	100	Unknown
Loch Haven Mutual Water Company	Wells	3	Unknown
Mark West Acres Mutual Water Company	Wells	25	Unknown
McChristian Water Supply	Unknown	Unknown	Unknown
Melita Heights Mutual Water Company	Wells	15	N
Michele Mutual Water Company	Unknown	25	Unknown
Mirabel Amusement Company	Unknown	150	Unknown
Muncy Water Company	Wells	4	N
Odd Fellows Recreation Club Water Co.	Wells & Springs	175	Unknown
Palomino Lakes Mutual Water Company	Wells	9	Cl_2
Park Royal Mutual Water Company	Wells	19	N
Preston Heights Mutual Water Company	Wells	14	Unknown
Price Water Company	Wells	12	N
Rancho Del Paradiso Water Company	Wells & Springs	43	N
Randal's Ranchette Mutual Water Company	Wells	22	N
Redwood Water Company Inc.	Wells & Springs	164	Cl_2
Riebli Water Company Inc.	Wells & Springs	164	Cl_2
Rincon Valley Mobile Estates	Wells	6	N
Rio Dell Water Company	Unknown	234	Unknown
Rio Lindo Academy Water Company	Wells	33	N
Russian River Mutual Water Company	Unknown	20	Unknown
Russian River Terrace Water Company	Unknown	350	Unknown
Sciarra Water Company	Unknown	307	Unknown
Sebastopol Municipal Water Department	Unknown	1,216	Unknown
Six Acres Water Company	Wells	22	N
Sonoma County Flood Control and Water Conservation District	Russian River	11,400	Cl_2
South Cloverdale Community Water Group	Wells	27	Unknown
Southwood Park Water Company	Unknown	60	Unknown
V. L. Bresaie Water System at Mirabel	Wells	138	Cl_2
Velluntini Water Company	Wells	20	Unknown
Vineyard Subdivision Mutual Water Company	Wells	Unknown	Unknown
Weat Water Company	Unknown	8	Unknown
Willis Mutual Water Company	Wells	9	Cl_2
Willowside Estates	Unknown	120	Unknown
Willowside Mutual Water Company	Wells	85	Cl_2
Wilshire Heights Mutual Water Company	Wells	15	N
Windsor Utility Corporation	Unknown	69	Unknown
Salvation Army Lytton Home	Springs	20	Unknown
East Austin Mutual Water Company	Unknown	14	Unknown
Rohnert Park District	Unknown	350	Unknown
Cotati Public Utility District	Unknown	225	Unknown

1/ Cl_2 denotes chlorination

F denotes flouridation

N denotes no treatment

Collectors can draw up to 40 million gallons per day from the underflow, some 60 feet below the riverbed.

Water pumped from the Ranney Collectors flows into a 12 million-gallon reservoir located just east of downtown Santa Rosa. The water is chlorinated prior to delivery by aqueduct to the various distribution systems.

Water systems within the watershed serve the City of Santa Rosa and the community of Forestville. Water systems served outside of the watershed are the City of Sonoma, the Valley of the Moon County Water District, the City of Petaluma, and the City of Novato in Marin County.

Future plans of the SCFCWCD depend on the construction of a dam at the confluence of Warm Springs Creek and Dry Creek (authorized) and dams on Maacama and Franz creeks (proposed). These dams will enable the District to supply the projected supplemental water requirements of Sonoma County, Southern Mendocino County, Marin County, and portions of Napa County.

The City of Santa Rosa

The second largest water supply system in the Russian River watershed is owned by the City of Santa Rosa. This system was put on a standby basis in 1959. Since 1959, the water supply for the city has been purchased from the Sonoma County Flood Control and Water Conservation District.

The city-owned water supply system has the capability to serve the present population of the city through about 12,000 service connections. The supply system includes a surface water diversion from Santa Rosa Creek at Melita Dam which can be impounded in the Lake Ralphine system along with water from various springs and wells. An underground infiltration gallery also supplies water to the system.

Other Water Systems

Some other prominent water supply systems within the watershed are: the Ukiah Municipal Water Department, serving 3,067 customers; Citizens Utilities of California, serving 2,950 customers; the Healdsburg Municipal Water Department, serving 1,752 customers; and the Sebastopol Municipal Water Department, serving 1,216 customers.

These and other smaller systems are supplied from wells or springs. Treatment, if any, is provided by chlorination.

Agricultural Use

Most of the water used for agriculture in the Russian River watershed is obtained by direct diversions of surface water or from shallow wells near the river. There are more than 13,000 acres of irrigated land in the watershed; crops include grapes, pears, and prunes. There is also a large amount of pasture land for dairy and beef cattle.

Recreational Use

The waters of the Russian River and its tributaries are used extensively for recreation. The area ranks high in visitor-days of use and recreation provides important economic benefits. The recreational value of the Russian River has been estimated to be 7,000,000 dollars annually. Future prospects are that this figure will continue to increase.(31) The major recreational activities are swimming, sportfishing, boating, and canoeing.

The region between Healdsburg and Duncans Mills receives the most use for water contact recreation. Temporary dams and natural pools impound water to form swimming areas at various locations along the river, including Healdsburg, Guerneville, and Rio Nido.

Swimming and wading activities are limited by cold water north of Healdsburg and in the tidal zones west of Duncans Mills. However, some swimming takes place as far north as Ukiah.

Lake Mendocino has greatly enhanced the recreational facilities of the watershed. The 1,700-acre lake has been estimated to have one million visitor-days of use per year. There are facilities for swimming, boating, and fishing, and it is one of the finest water skiing areas in the State.

Lake Mendocino has two large boat docks and two boat launching ramps which make boating a popular activity.

There is also extensive boating and canoeing on the Russian River where there are many boat launching areas south of Healdsburg. Canoe trips starting down the river from Healdsburg are quite popular.

Fishing and Fish Propagation

Fisheries resources of the Russian River drainage area include king and silver salmon, steelhead, striped bass, American shad, and a variety of warmwater species. Of the warmwater species, largemouth bass and smallmouth bass are most important to anglers. Many nongame species are present throughout the drainage area but are of little value to the fishery. Species of fish inhabiting the Russian River system are presented in Table 2.

TABLE 2

FISHES OF THE RUSSIAN RIVER DRAINAGE

Common Name	Scientific Name
Pacific lamprey	Entosphenus tridentatus
Brook lamprey	Lampetra planeri
White sturgeon	Ocipenser transmontanus
Green sturgeon	Ocipenser medirostris
American shad	Alosa sapidissima
Pink salmon	Oncorhynchus gorbuscha
Silver salmon	Oncorhynchus kisutch
King salmon	Oncorhynchus tshawytscha
Brown trout	Salmo trutta
Steelhead trout	Salmo gairdnerii
Western sucker	Catostomus occidentalis
Carp	Cyprinus carpio
Greaser blackfish	Orthodon microlepidotus
Hardhead	Mylopharodon conocephalus
Hitch	Lavinia exilicauda
Sacramento squawfish	Ptychocheilus grandis
Splittail	Pogonichthys macrolepidotus
Venus roach	Hesperoleucus venustus
White catfish	Ictalurus catus
Mosquitofish	Gambusia affinis
Striped bass	Roccus saxatilis
Smallmouth bass	Micropterus dolomieu
Largemouth bass	Micropterus salmoides
Green sunfish	Lepomis cyanellus
Bluegill	Lepomis macrochirus
Sacramento perch	Archoplites interruptus
Black crappie	Pomoxis nigromaculatus
Tule perch	Hysterocarpus traskii
Riffle sculpin	Cottus gulosus
Prickly sculpin	Cottus asper
Aleutian sculpin	Cottus aleuticus
Three-spined stickleback	Gasterosteus acceleatus

The Russian River drainage area supports one of the most important salmonid runs in the Central Coastal Area. An estimated 62,000 steelhead and 7,500 salmon use this drainage annually for spawning and nursery grounds.

There are approximately 234 miles of salmon and 660 miles of steelhead habitat in the drainage area. King salmon use the upstream portions of the larger streams for spawning. Silver salmon restrict their spawning to a few tributaries in the lower part of the drainage. Steelhead spawn in most of the tributaries of the Russian River. A breakdown, by miles, of the Russian River and its tributaries used by salmonids is presented in Table 3.

The total angler effort for salmon and steelhead was estimated to be about 70,000 angler days per year. A division of angler effort is arbitrary as salmon and steelhead are caught by the same anglers.

The annual harvest of salmonids is about 2,000 salmon and about 12,000 steelhead.

Although a fishery exists for striped bass, American shad, and warmwater game fish, there is little detailed information on the distribution, abundance, and yield of these species.

King salmon is the only species which has been stocked in the river system within the past 20 years. Since 1959, approximately two million fingerlings have been released to develop a winter run of king salmon.

Historically, steelhead and silver salmon rescued from streams in Sonoma and Mendocino counties have been planted in the Russian River.

Catchable trout are planted in several of the reservoirs within the Russian River drainage area. The East Fork of the Russian River was planted with catchable trout in 1965 and 1966.

TABLE 3

RUSSIAN RIVER AND TRIBUTARIES USED BY SALMONIDS

Sonoma County Streams	Total Miles	Total Miles Used by KS	SS	SH
Jenner Gulch	0.5			0.5
Sheep House Gulch	0.5		0.5	0.5
Austin Creek	7.5		4	7.5
Ward Creek	14.5		14.5	14.5
Kid Creek	2		2	2
Bear House Creek	3		3	3
Redside Creek	1.5			1.5
Kohute Gulch	0.5		0.5	0.5
Black Rock Creek	1.5		1.5	1.5
East Austin Creek	12.5		10.5	12.5
Sulphus Creek	0.5			0.5
Devils North Ford Creek	1.5			1.5
Gray Creek	3.5			3.5
Thompson Creek	1		3	3
Gilliam Creek	3			3
Hulbert Creek	5.5			5.5
Fife Creek	6.5			6.5
Hobson Creek	1			1
Porter Creek	8		2	8
Dry Creek	30.5		11	30.5
Mill Creek	10		3	10
Felta Creek	4		1	4
Wallace Creek	4		3.5	4
Pine Ridge Creek	1			1
Crane Creek	1.5			1.5
Grape Creek	1.5			1.5
Healdsburg Slough	4.5			4.5
Pena Creek	15.5		8	15.5
Warm Springs	10.5			10.5
Strawberry Creek	1			1
Galloway Creek	6			6
Henry Creek	10			10
Yorty Creek	4			4
Smith Creek	5			3
Rail Creek	2			2
Dutch Creek	3			3
Barrelli Creek	1			1
Icarica Creek	4			4
Cloverdale Creek	2			2
Oat Valley Creek	3.5			3.5
Big Sulphur Creek	19.5			14.5
Frasier Creek	1.5			1.5
Squaw Creek	9.5			9.5
Little Sulphur Creek	16			16
Pine Mountain Creek	1			1
Crocker Creek	1.5			1.5
Gill Creek	2			2
Miller Creek	2.5			2.5
Sausal Creek	10			8

Sonoma County Streams (Cont'd)	Total Miles	Total Miles Used by KS	SS	SH
Maacama Creek	6.5			6.5
Redwood Creek	4.5			4.5
Kellog Creek	6			4.5
Franz Creek	13			13
McDonnell Creek	3			3
Ingalls Creek	2			1.5
Mark West Creek	28			28
Porter Creek	7			7
Horse Creek	1.5			1.5
Van Buren Creek	1			1
Humbug Creek	2			2
Winsor Creek	11.5			11.5
Weeks Creek	2			2
Santa Rosa Creek	17.5			17.5
Matanzas	7.5			5.5
Green Valley Creek	16		16	16
Smith Creek	1.5		1.5	1.5
Dutch Creek	8		8	8
Freeze Out Creek	1		1	1
Willow Creek	6		6	6
Russian River	66	66	31.5	66
Unnamed Tributaries	20.5			20.5
Mendocino County Streams				
Dry Creek	20			20
Comminsty Creek	7			7
Pieta Creek	17			17
Dooley Creek	6			6
Felis Creek	16			16
Duncan Creek	1			1
Crawford Creek	0.5			0.5
Parsons Creek	1.5			1.5
Morris Creek	1.0			1.0
Robinson Creek	9.0			9.0
Howell Creek	4.0			4.0
Doolin Creek	6.5			6.5
Mill Creek	3.5			3.0
Sulphur Creek	1.5			1.5
Orrs Creek	6.0			6.0
Henesley Creek	1.0			1.0
York Creek	2.0			2.0
East Branch Russian River	23.0	1		1
Forsythe Creek	19			19
Ackerman	9			9
Unnamed Tributaries	4			4
Russian River	43.5	34.5		43.5

Management of the Russian River drainage fisheries resources is directed toward maintaining existing game fish populations at present levels of abundance and, where possible, to increase these resources.

Management tools include: salvage of salmon and steelhead juveniles stranded in intermittent tributaries for transport to live waters, removal of logging debris and other materials which block or hinder the upstream migration of adult fish to their ancestral spawning grounds, modification of natural barriers to allow use of previously inaccessible areas, chemical treatment to remove or reduce nongame fishes which compete with game fishes, and planting of game fishes to augment existing populations.

Waste Assimilation

The assimilative capacity of the Russian River is currently used directly or indirectly, for disposal of waste water from five significant dischargers (0.5 mgd or greater): the cities of Santa Rosa, Healdsburg, Cloverdale, Ukiah, and Sebastopol. Healdsburg, Cloverdale, Sebastopol, and Ukiah discharge treated waste water into the Russian River or its tributaries during the high flow periods of the winter but retain the effluent on land during the recreation season (usually from Memorial Day to Labor Day). Santa Rosa discharges waste water into Santa Rosa Creek throughout the year.

Untreated wastes from apple processing plants near Sebastopol are discharged into tributaries of the Laguna de Santa Rosa and Green Valley Creek each fall during the packing season.

The assimilative capacities of some tributaries to the Russian River are being approached rapidly, particularly in the Laguna area. In the future, as waste discharges within the watershed increase in volume, safe disposal of the anticipated quantities will present many problems. These problems should be given careful consideration due to the potential hazard to water-contact sports enthusiasts from pathogenic organisms often present in sewage effluents. The presence of sewage effluents in the Russian River also results in nuisance conditions such as algal blooms due to excessive concentrations of nutrients (nitrates and phosphates).

Industrial Use

Industrial water use within the Russian River watershed is limited. There are about ten surface water diversions for industrial purposes. Undoubtedly some of the wineries and other small industries draw water from wells. The number of these is not known.

CHAPTER IV. SURFACE WATER HYDROLOGY

As in most of western California, the quantity and distribution of runoff is generally determined by the climatic, geologic, and topographic characteristics of the Russian River watershed. A knowledge of the seasonal precipitation and runoff patterns is essential before accurate water quality predictions can be made.

Climate Characteristics

The Russian River Basin has a mediterranean-type climate with dry summers and wet winters. Local variations in climate occur because of proximity to the Pacific Ocean and differences in elevation. An established network of climatology stations exists in the study area, and several stations have records from about 1880.

Average monthly temperatures in the basin range from a minimum of 42°F to a maximum of 74°F, but extreme temperatures of 12 and 116°F have been recorded. As would be expected, the coastal region of the drainage area is cooler than the valleys.

Precipitation over most of the watershed is in the form of rain and shows wide seasonal variations. Any snow falling on the higher elevations melts quickly and does not retard runoff. An 80-year broken record of seasonal precipitation at Ukiah shows extreme values of 13.09 and 60.97 inches with a mean value of 35.47 inches. These quantities are quite typical of the valleys. Cazadero, in the mountains of the coastal reach of the watershed, has a mean seasonal rainfall of 74.34 inches and extreme values of 44.02 and 123.24 inches. Table 4 shows mean maximum and minimum annual precipitation for 11 stations in the Russian River watershed.

TABLE 4

MEAN, MAXIMUM, AND MINIMUM ANNUAL PRECIPITATION AT SEVERAL STATIONS IN THE RUSSIAN RIVER WATERSHED

Station	Length of Record (years)	Mean Annual Precipitation (inches)	Maximum Annual Precipitation (inches)	Minimum Annual Precipitation (inches)
Cazadero	25	74.34	123.24 (1957-58)	44.02 (1963-64)
Cloverdale	53 1/	39.04	67.73 (1940-41)	13.54 (1923-24)
Graton	69	39.88	70.56 (1940-41)	18.04 (1923-24)
Guerneville	25	46.79	79.56 (1957-58)	31.10 (1946-47)
Healdsburg	88	39.94	72.65 (1889-90)	15.35 (1884-85)
Hopland	22	34.99	58.18 (1957-58)	22.49 (1943-44)
Kellogg	22	43.20	65.63 (1964-65)	27.86 (1954-55)
Potter Valley	33	44.73	71.46 (1937-38)	29.98 (1938-39)
Santa Rosa	77	29.45	56.06 (1889-90)	12.83 (1918-19)
Skaggs Springs	25	60.34	98.83 (1940-41)	39.11 (1946-47)
Ukiah	80 2/	35.47	60.97 (1889-90)	13.09 (1923-24)

1/ Intermittent record to 1955. Record since this date not included because station location changed in 1956.

2/ Intermittent record.

The annual precipitation values in Table 4 are based on the water year (October to September). This time period allows for easier comparison with annual runoff, which is calculated for the 12-month period from October to September.

The monthly distribution of annual precipitation is typical of California's coastal areas. The rainy period extends from October through May, with December and January the wettest months. The summer months of July, August, and September are virtually dry throughout the watershed.

Runoff Characteristics

Within the watershed, the United States Geological Survey operates 16 stream gaging stations. There are continuous records from 1939 for three stations on the main stem of the Russian River, and records for two tributary stations go back to 1941. All of the other stations have been constructed since 1950.

Table 5 shows the location of 13 of the stream gaging stations, their drainage area, periods of record, and quantities of mean annual runoff. Three recently constructed stations are omitted from the table because their records are too short to be of value in predicting water quality.

The runoff pattern for the drainage basin generally reflects the wet winters and dry summers of the area. Nearly 90 percent of the annual runoff occurs in the six-month period from December through April. Table 6 presents the monthly distribution of annual runoff for the Russian River near Guerneville. Although Coyote Dam has reduced the peak winter flows and increase summer discharge in the main stem since 1958, the mean monthly discharge distribution prior to this date does not differ significantly from the figures shown in Table 6.

TABLE 5

MEAN ANNUAL RUNOFF FOR SELECTED STATIONS
IN THE RUSSIAN RIVER DRAINAGE AREA

Station	Drainage Area (square miles)	Period of Record	Mean Annual Runoff (acre-feet/year)
Russian River near Ukiah	99.7	1911-13 1952-64	120,900
East Fork Russian River near Calpella	93.0	1941-64	234,600
East Fork Russian River near Ukiah	105	1911-13 1951-64	236,700 1/
Russian River near Hopland	362	1939-64	502,400
Feliz Creek near Hopland	31.1	1958-64	27,290
Russian River near Cloverdale	502	1951-64	689,900
Big Sulphur Creek near Cloverdale	82.3	1957-64	122,400
Russian River near Healdsburg	793	1939-64	995,500
Dry Creek near Cloverdale	87.8	1941-64	109,300
Dry Creek near Geyserville	162	1959-64	174,500
Santa Rosa Creek near Santa Rosa	12.5	1959-64	9,630
Russian River near Guerneville	1,340	1939-64	1,580,000
Austin Creek near Cazadero	63.1	1959-64	113,700

1/ Regulated by Coyote Dam since 1958.

TABLE 6

MONTHLY DISTRIBUTION OF ANNUAL RUNOFF
RUSSIAN RIVER NEAR GUERNEVILLE
25-year average (1939-40 to 1963-64)

Month	Mean Monthly Runoff (acre-feet)	Percent of Annual Runoff
October	25,630	1.6
November	45,990	2.9
December	253,110	16.0
January	344,640	21.8
February	403,370	25.5
March	250,270	15.9
April	158,670	10.0
May	49,410	3.1
June	18,730	1.2
July	10,250	0.7
August	9,460	0.6
September	10,960	0.7

Except for the East Fork of the Russian River, the main stem, and tributaries receiving waste discharges, the watershed can be said to exhibit natural flow. Most of the tributary streams in the watershed show rapid rise and decline with storms, characteristic of relatively small drainage areas with few works to retard the flow. The main stem of the Russian River is slower to peak and retains higher stages longer after a storm. Flooding of the lower reach of the Russian River occurs frequently following a high intensity storm which covers a large area. This problem exists because most of the tributary streams peak simultaneously and overtax the capacities of the main channels.

Lake Mendocino, formed by Coyote Dam on the East Fork of the Russian River near Ukiah, is the only sizable reservoir in the watershed at present. The 122,500 acre-foot reservoir was constructed by the United States Army Corps of Engineers in 1958 as a multiple-purpose facility. The Corps of Engineers operates it for flood control, water conservation, and recreation. Coyote Dam must release enough water during the summer to maintain a flow of 125 cfs at Guerneville. A temporary dam, placed in the main river at Guerneville during the recreation season to create a swimming area, does not affect the winter runoff.

Approximately 141,000 acre feet of Eel River water is imported annually through Pacific Gas and Electric Company's Potter Valley Powerhouse. This water is discharged to the East Fork of the Russian River and is regulated by Coyote Dam. The Sonoma County Flood Control and Water Conservation District has applied for water rights for the imported water. Before Coyote Dam was built, this imported water prevented the lower reach of the river from drying up during the summers.

There are two small exports of water from the basin. One is southeast of Santa Rosa on Copeland Creek and diverts water into Petaluma Reservoir. The second is operated by the Sonoma County Flood Control and Water Conservation District to deliver water from the Russian River south to Petaluma and Novato.

Most of the streams in the watershed supply some agricultural water to adjacent farmland. Many private direct diversions for irrigation are made from the main stem of the river between Ukiah and Mirabel Park and from the entire length of Dry Creek.

The only municipal surface water diversion of any size in the watershed is operated by the Sonoma County Flood Control and Water Conservation District to supply Santa Rosa and vicinity. This pumping installation currently produces about 15,000 acre feet per year. The Sonoma County Flood Control and Water Conservation District presently has permits to use water from the existing stage of Lake Mendocino, and from the Russian River during winter flows. An application is on file for a permit to use water from Warm Springs Reservoir when it is completed. An application is also on file to use water imported through the Potter Valley Powerhouse.

None of these diversions significantly affects the winter discharge of the Russian River, but the agricultural use greatly reduces summer runoff. During late summer, more water is released from Lake Mendocino than reaches Guerneville even with the flow contributed by intermediate tributaries.

CHAPTER V. GROUND WATER GEOLOGY AND HYDROLOGY

The Russian River watershed includes Santa Rosa Valley, Alexander Valley, Cloverdale Valley, Sanel Valley, Ukiah Valley, and Potter Valley ground water basins plus intervening areas from the headwaters to the mouth of the Russian River.

The geologic formations in the Russian River area have been divided into two groups: nonwater-bearing and water-bearing. This division is based on the ability of the formations to yield water to wells. A water-bearing formation is one that absorbs, transmits, and yields water readily to wells, and conversely a nonwater-bearing formation is one from which wells produce relatively limited quantities of water. In general, this division can be based also on age, because the water-bearing group includes formations that are Tertiary and younger while the nonwater-bearing group includes those formations that are older than Tertiary. The surficial extent of the water-bearing and nonwater-bearing rocks in the Russian River area are presented on Plate 2.

Nonwater-Bearing Rocks

Nonwater-bearing rocks are those of the Franciscan and Knoxville Formations, of Jura-Cretaceous age, and massive conglomerate of possible Cretaceous age. These rocks, shown on Plate 2, outcrop only in the mountainous areas. They also occur at depth beneath the valleys.

The Franciscan and Knoxville formations consist of a series of sedimentary, metamorphic, and igneous rocks that have a maximum thickness of at least 40,000 feet. The sedimentary portion is composed predominantly of sandstone, mudstone, shale, limestone, chert, and conglomerate. Some metamorphic and igneous rocks, such as serpentine, gabbro, glaucophane schist, pillow basalt, greenstone, and silica-carbonate rock are associated with the sediments in certain areas. These rocks are intensely folded and faulted, and in many places there are zones of shearing and crushing. Rocks of the Franciscan and Knoxville Formations are generally so well consolidated that they yield little, if any, ground water. Locally, small supplies of poor to fair quality domestic or stock water have been developed in areas of deeply weathered or highly fractured rock.

The Cretaceous conglomerate consists of pebbles and cobbles enclosed in a matrix of hard, coarse sand. The conglomerate, which is at least 5,000 feet thick, has been folded into a northwest-trending syncline. A number of wells yield ground water from the conglomerate in quantities adequate for domestic and stock use. Those located along the axis of the syncline yield water under artesian head. Well 10N/9W-32R3 reportedly flows at a rate of 19 gpm. Table 7 gives the yield characteristics of a well which taps the Cretaceous conglomerate. Ground water contained in the conglomerate is usually a sodium bicarbonate water with a moderately high percentage of sodium. A summary of the chemical character of ground water in the Cretaceous conglomerate is shown in Table 8.

Water-Bearing Rocks

Water-bearing rocks are found in and adjacent to all valley areas in the Russian River drainage basin. The most important of these range in age from Plio-Pleistocene to Recent. An older rock unit, of Pliocene age, is also included although it is of only local importance as a source of ground water.

TABLE 7

RANGE OF YIELD CHARACTERISTICS OF WELLS, RUSSIAN RIVER AREA

Area	Geologic Formation[1/]	Number Of Wells	Depth (feet)	Yield (gpm)	Specific Capacity (gpm/ft)	Transmissibility[2/] (gal/day/ft)
Santa Rosa	Tsv	5	200-1,018	290-485	1.10-5.75	2,200-11,500
	TQm	8	132-1,204	125-1,620	0.96-5.56	1,920-11,120
	TQge	13	80-914	100-550	1.25-7.16	2,500-14,320
	Qal	3	154-161	100-545	2.38-6.25	4,760-12,500
Lower Valley	TQm	1	352	43	1.0	2,000
	Qal	1	183	110	2.2	4,200
Healdsburg	TQge	1	209	200	7.15	14,300
	Qt	2	111-151	20-400	0.45-4.65	900- 9,300
	Qsc	4	31-66	350-1,000	62.5 -200.0	125,000-400,000
Alexander Valley	Kc	1	122	6	0.086	172
	TQge	4	105-454	40-400	0.50-8.00	1,000- 16,000
	Qt	1	180	435	4.35	8,700
	Qal	1	180	150	1.36	2,720
Cloverdale Valley	Qsc	1	35	500	250.0	500,000
Sanel Valley	TQc	2	187-220	70-155	1.07-3.53	2,140- 7,060
	Qal	2	61-220	100-550	3.55-20.0	7,100- 40,000
	Qsc	1	47	950	238.0	476,000
Ukiah Valley	TQc	2	64-199	18-246	1.1 -14.5	2,200- 29,000
	Qt	1	93	30	0.38	720
	Qal	4	108-215	230-892	3.11-15.4	6,220- 30,800
	Qsc	2	22-34	525-1,350	65.5 -450.0	131,000-900,000
Potter Valley	No yield data available					

1/ Qsc: Stream channel deposits; Qal: Alluvium; Qt: Terraces; TQc: Plio-Pleistocene sediments; TQge: Glen Ellen Formation; Tm: Merced Formation; Kc: Cretaceous conglomerate.

2/ Transmissibility determined by the modified Thiem equilibrium formula where T = 2,000* x specific capacity. 2,000* actually 1,990, is a factor for confined aquifer conditions.

TABLE 8

SUMMARY OF CHEMICAL CHARACTER OF GROUND WATER IN WATER-BEARING MATERIALS

Area	Geologic Formation*	Water Type	EC (micromhos)	Cl (ppm)	B (ppm)	NO_3 (ppm)	Na (%)	Total Hardness (ppm)	N.C. Hardness (ppm)
Santa Rosa	Tsv	$NaHCO_3$	476-531	21-31	0.3-1.0	0.0-12	28-40	156-169	0-7
	Tm	$NaHCO_3$ $Ca(HCO_3)_2$	187-307	15-31	0.0-0.31	0.0-0.31	0.0-0.31	45-117	0-9
	TQge	$MgHCO_3$ $NaHCO_3$ $Ca(HCO_3)_2$	246-820	17-49	0.0-0.84	0.0-25	21-68	61-319	0-41
Lower Valley	Qal	$MgHCO_3$	335	9.5	0.27	0.6	13	154	9
	Qsc	$MgHCO_3$	285	9.6	---	0.0-1.8	7-21	132-149	0
Healdsburg	Qsc	$MgHCO_3$	285	22	0.14	7.7	13	126	17
Alexander Valley	Kc	$NaHCO_3$	457	13	0.0	0.0	63	89	0
	TQge	$NaHCO_3$	350-583	15-41	0.12-0.34	0.0-0.8	37-92	16-114	0
	Qsc	$MgHCO_3$ $Ca(HCO_3)_2$	323-329	6.5-18	0.18-0.4	5.6-8.3	10-13	151-170	12-14
Cloverdale Valley	Qt	$NaHCO_3$ $Ca(HCO_3)_2$	239-248	7.5-30.0	0.6-0.8	0.6-11.0	19	65-111	0
	Qal	$Ca(HCO_3)_2$	310	10	0.16	---	11	180	0
	Qsc	$Ca(HCO_3)_2$	283-366	7.5-9.3	0.3	0.0-1.4	10-17	155-183	0
Sanel Valley	TQc	$MgHCO_3$	327	8.5	0.42	0.0	19	230	0
	Qal	$MgHCO_3$ $Ca(HCO_3)_2$	229-349	4.8-9.0	0.02-0.44	1-11	21-32	96-166	0-9
	Qsc	$MgHCO_3$	335-351	5.5-11.0	0.08-1.87	2.7-8.0	5-22	147-177	0.15
Ukiah Valley	Qt	$MgHCO_3$ $Ca(HCO_3)_2$	223-371	12-29	0.0-0.1	0.9-8.0	25-36	84-139	0-12
	Qal	$NaHCO_3$ $MgHCO_3$ $Ca(HCO_3)_2$	339-566	3.8-23.0	0.05-1.14	0.0-2.0	13-40	138-214	0-12
	Qsc	$MgHCO_3$ $Ca(HCO_3)$ $Ca(HCO_3)_2$	208-483	4.8-13.0	0.11-0.24	0.0-27.0	12-60	86-182	0-32
Potter Valley	Qt	$MgHCO_3$ $Ca(HCO_3)_2$	243-269	7.2-8.0	0.12	1.5-21.0	12-18	107-120	0-21
	Qal	$MgHCO_3$ $Ca(HCO_3)_2$	232-593	3.7-22.0	0.04-0.61	0.1-3.5	12-18	105-245	0-22

* Qsc: Stream channel deposits; Qal: Alluvium: Qt: Terraces; TQc: Plio-Pleistocene Sediments; TQge: Glen Ellen Formation; Tm: Merced Formation; Tsv: Sonoma volcanics; Kc: Cretaceous conglomerate.

Sonoma Volcanics

The Sonoma volcanics, of Pliocene age, are exposed in the Mayacmas Mountains and at scattered localities near Healdsburg and Alexander Valley. In the sub-surface, the Sonoma volcanics are suspected to underlie much of the Santa Rosa area.

The Sonoma volcanics consist of an extremely complex series of lava flows, agglomerates, pumice beds, tuffs, and intercalated volcanic sediments. Intense folding and faulting is common and obscures much of the original structure. The volcanic sequence is believed to be at least 2,000 feet thick.

The lava flows are largely impervious and act as confining beds which restrict vertical movement of ground water. Small amounts of water may be obtained locally from fractured or scoriaceous zones. Inter-stratified pumice tuff, tuff-breccia, and redeposited tuff yield ground water in non-uniform quantities; the amount of yield depends on the nature of the interstitial openings. For example, well 7N/7W-32G1 in Bennett Valley, has an artesian flow of only 150 gpm from stratified ash and tuff deposits, while nearby well 6N/7W-3Q1 reportedly yields up to 1,500 gpm from similar materials. Table 7 presents the range of yield characteristics of wells tapping the Sonoma volcanics.

Ground water in the Sonoma volcanics is usually a satisfactory quality sodium bicarbonate water. Boron concentrations of up to 1.0 ppm have been reported. Because of a higher than average geothermal gradient, ground water from deep wells in the Sonoma volcanics is somewhat warmer than that found in other formations. This is illustrated by well 7N/7W-32G1, a 403-foot deep well that produces water of 74°F temperature, which is about 8° warmer than water found in wells of comparable depth in other nearby formations. Table 8 shows a summary of the chemical character of ground water contained in the Sonoma volcanics.

Merced Formation

The Merced Formation is a fossiliferous marine deposit consisting of massive beds of fine sand, thin interbeds of clay and silt, lenses of gravel, and stringers of pebbles. The lower part contains a zone of pumiceous tuff. The Merced Formation is exposed on the western side of Santa Rosa Valley, from Sebastopol to the drainage divide. It ranges in thickness from only a few feet at its western extremity to a maximum of about 1,500 feet beneath the Santa Rosa Plain. Because of its lateral extent and moderate transmissibility, the Merced Formation is one of the most important water-bearing units in the Russian River area. Yields of properly constructed wells range up to more than 1,600 gpm. Table 7 presents a summary of the yield characteristics of wells tapping the Merced Formation.

Ground water in the Merced Formation is usually a sodium-calcium bicarbonate water of excellent quality. Locally, wells tapping unoxidized (blue) sandstone may yield water high in iron or manganese. Table 8 shows a summary of the chemical character of ground water contained in this formation.

Glen Ellen Formation

The Glen Ellen Formation consists of poorly sorted, lenticular deposits of silty clay, clayey gravel, sand, and gravel. The lower part is tuffaceous and contains lenses of cobble conglomerate. The formation is exposed over broad areas in Santa Rosa Valley as erosional remnants along Dry Creek northwest of Healdsburg and as extensive deposits at the southeastern end of Alexander Valley. It is also suspected that this formation occurs in adjacent valley areas beneath a relatively thin veneer of younger materials. Along the eastern side of Santa Rosa Valley, the Glen Ellen Formation is at least 3,000 feet thick. It diminishes to about 1,500 feet in thickness along the western side of the valley. In the Healdsburg area and in Alexander Valley, it is estimated to be about 1,000 feet thick.

Beneath Santa Rosa Valley, the water-yielding characteristics of the Glen Ellen Formation vary considerably. Wells less than 100 feet in depth will usually provide sufficient water for domestic purposes while it may be necessary to go to as deep as 1,000 feet for irrigation quantities. Certain wells may be fairly close together yet have markedly different yield characteristics. This is illustrated by wells 8N/8W-17L1 and 8N/8W-20Q1, which are 1-1/2 miles apart. Well 8N/8W-17L1 is 278 feet deep and yielded 10 gpm with a drawdown of 100 feet and a specific capacity of 0.1; in contrast, well 8N/8W-20Q1 is 312 feet deep and yielded 300 gpm with a drawdown of 10 feet and a specific capacity of 30. This range is probably near the extreme for the formation.

In the Healdsburg area, the permeability of the Glen Ellen Formation is low to moderate. Well yields range from 10 to 200 gpm; specific capacities generally range from 2 to 8.

Well yields from the Glen Ellen Formation in Alexander Valley are about the same as those near Healdsburg. Well yields range from

25 to 400 gpm and specific capacities from 0.5 to 8. Table 7 presents a summary of the yield characteristics of wells tapping the Glen Ellen Formation.

Ground water in the Glen Ellen Formation has a greater range in character than that in any other formation within the watershed. Some of the best and some of the poorest quality water is obtained from this formation. Ground water is usually a sodium-calcium bicarbonate or magnesium bicarbonate water of excellent quality. Boron concentrations of up to 1.0 ppm have been reported, as has water containing over 90 percent sodium. Table 8 presents a summary of the chemical character of ground water in this formation.

Plio-Pleistocene Sediments

Continental sediments of Pliocene to Pleistocene age are exposed in Sanel, Ukiah, and Potter valleys. These sediments may be equivalent in part to similar sediments of the Glen Ellen Formation found to the south. The Plio-Pleistocene sediments consist of lenticular beds of compact silty clay, sandy clay, clayey gravel, sandy gravel, and silty sandstone, which originated as alluvial fans, lake deposits, and alluvium. The deposits are believed to be at least 2,000 feet thick.

The water-bearing potential of these deposits varies widely depending on the materials intercepted. In Sanel Valley, well 13N/11W-8H1 is 187 feet deep and reportedly yields 75 gpm, with a drawdown of 70 feet and a specific capacity of 1.07. In contrast, well 13N/11W-21Q1 is 220 feet deep and yields 550 gpm with a drawdown of 155 feet and a specific capacity of 3.53.

The Plio-Pleistocene sediments in Ukiah Valley yield fair to moderate quantities of water to wells. Yields range from less than 100 gpm to over 500 gpm and specific capacities from 1 to 15.

In Potter Valley, yields to wells tapping the continental sediments are generally low, usually not exceeding 25 gpm. This is because of a general fineness of grain of the sediments in this valley.

Table 7 presents a summary of the yield characteristics of wells tapping the Plio-Pleistocene sediments in Sanel and Ukiah valleys. There are no reliable data available for Potter Valley.

Ground water contained in the Plio-Pleistocene sediments is generally a good quality calcium-magnesium bicarbonate water. Table 8 presents a summary of the chemical character of ground water in these sediments.

Terrace Deposits

Terrace deposits occur discontinuously from Rio Dell upstream along the Russian River to Ukiah Valley and Potter Valley, and along Dry Creek above Healdsburg.

Along Dry Creek, there are five terrace levels with an aggregate thickness of at least 200 feet. Cloverdale Valley has three terrace levels with a total thickness of more than 100 feet. In Ukiah Valley, the terraces are more than 200 feet thick, while in Potter Valley, they are about 100 feet thick. There are no terraces in Alexander and Sanel valleys. The terraces are remnants of old alluvial fans and valley alluvium and consist of cross-bedded deposits of silty clay, sandy silt, sandy gravel, and a few cobbles. In Potter Valley, fines predominate, while terraces at other locations contain more of the coarse material.

Wells tapping the terrace deposits generally yield 10 to 100 gpm, although yields of up to 435 gpm may be derived from very coarse material. Table 7 presents a summary of the yield characteristics of wells tapping the terrace deposits.

Ground water in the terrace deposits is usually a good quality calcium-magnesium bicarbonate water. Boron concentrations of up to 0.8 ppm have been reported. Table 8 presents a summary of the chemical character of ground water in the terraces.

Alluvium and Stream Channel Deposits

Alluvium, in the form of flood plain, alluvial fan, and colluvial deposits occurs in all valley areas from the mouth of the Russian River upstream to Potter Valley. Stream channel deposits occur along the active channels of the Russian River and Dry Creek.

The alluvium is up to 200 feet thick and consists of unconsolidated, poorly sorted clay, silt, sand, and gravel. Yields to wells range from 100 gpm to 900 gpm, depending on the coarseness of the materials intercepted. Ground water is usually a good quality calcium-magnesium bicarbonate water. Excessive amounts of boron may be present.

The stream channel deposits consist of unconsolidated sand, gravel, cobbles, and boulders. The deposits are of high to very high permeability and yield large quantities of water to wells. Ground water is usually a good quality calcium-magnesium bicarbonate water. Excess boron and sodium percentages have been reported from several wells.

Table 7 presents a summary of the yield characteristics of wells tapping the alluvium and stream channel deposits. Table 8 presents a summary of the chemical character of ground water in these materials.

CHAPTER VI. WATER QUALITY CRITERIA

When dealing with observation and measurement of physical data, there must be a yardstick or standard which can be used to judge or classify the information gathered. The investigator who is working with water quality data must determine if the water is suitable for the anticipated use or uses.

Criteria presented in this chapter can be used to evaluate the mineral quality of water as it relates to the broad categories of beneficial uses indicated. It should be noted that these criteria are merely guidelines to the appraisal of water quality. Except for those constituents which are considered toxic to human beings, these criteria are suggested, rather than mandatory, limiting values. When the quality of the water exceeds one or more of the limiting values the water need not be eliminated from consideration as a source of supply, but other sources of better quality water should be investigated.

Criteria for Drinking Water

Criteria for evaluating the suitability of water for domestic and municipal use have been established by the United States Public Health Service. The limiting concentrations of chemical substances in drinking water have been abstracted from these criteria and are shown in Table 9. Organic, bacteriological, or other chemical substances may be limited if their presence renders the water hazardous for use.

TABLE 9

UNITED STATES PUBLIC HEALTH SERVICE
DRINKING WATER STANDARDS, 1962

Chemical Substance	Mandatory limit in ppm
Arsenic (As)	0.05
Barium (Ba)	1.0
Cadmium (Cd)	0.01
Hexavalent chromium (Cr^{+6})	0.05
Cyanide (Cn)	0.2
Fluoride (see Table 12)	
Lead (Pb)	0.05
Selenium (Se)	0.01
Silver (Ag)	0.05
	Nonmandatory, but recommended limit in ppm
Alkyl benzene sulphonate (detergent)	0.5
Arsenic (As)	0.01
Carbon chloroform extract (exotic organic chemicals)	0.2
Chloride (Cl)	250
Copper (Cu)	1.0
Cyanide (Cn)	0.01
Fluoride (F) (see Table 12)	
Iron (Fe)	0.3
Manganese (Mn)	0.05
Nitrate (NO_3)	45
Phenols	0.001
Sulfate (SO_4)	250
Total dissolved solids	500
Zinc (Zn)	5

The United States Public Health Service also has recommended maximum concentrations of radioactivity allowable in drinking water. These are shown in Table 10.

TABLE 10

UNITED STATES PUBLIC HEALTH SERVICE
ALLOWABLE CONCENTRATIONS OF RADIOACTIVITY IN DRINKING WATER

Constituent	Recommended maximum limits, micromicrocuries per liter
$Radium^{226}$	3
$Strontium^{90}$	10
Gross beta activity	1,000 1/

1/ In the known absence of $strontium^{90}$ and alpha emitters.

Drinking water should not contain impurities which offend the sense of sight, taste, or smell. The United States Public Health Service has suggested limits for physical characteristics which are shown in Table 11.

TABLE 11

UNITED STATES PUBLIC HEALTH SERVICE
RECOMMENDED LIMITS OF PHYSICAL CHARACTERISTICS IN DRINKING WATER

Characteristic	Recommended limit
Turbidity, units	5
Color, units	15
Threshold odor number	3

When fluoride is naturally present in drinking water, the concentration should not average more than the appropriate upper limit shown in Table 12. Presence of fluoride in average concentrations greater than two times the optimum values in the tabulation shall constitute grounds for rejection of the supply.

TABLE 12

UNITED STATES PUBLIC HEALTH SERVICE
FLUORIDE-TEMPERATURE RELATIONSHIPS

Annual Average of Maximum Daily Air Temperatures 1/	Recommended Control Limits -- Fluoride Concentration in mg/l		
	Lower	Optimum	Upper
50.0-53.7	0.9	1.2	1.7
53.8-58.3	0.8	1.1	1.5
58.4-63.8	0.8	1.0	1.3
63.9-70.6	0.7	0.9	1.2
70.7-79.2	0.7	0.8	1.0
79.3-90.5	0.6	0.7	0.8

1/ Based on temperature data obtained for a minimum of 5 years.

The California State Board of Public Health also has defined the maximum safe amounts of fluoride ion in drinking water in relation to mean annual temperature. These relationships are shown in Table 13.

TABLE 13

CALIFORNIA STATE BOARD OF PUBLIC HEALTH
FLUORIDE-TEMPERATURE RELATIONSHIPS

Mean annual temperature	Mean monthly fluoride ion concentration
50°F	1.5 ppm
60°F	1.0 ppm
70°F - above	0.7 ppm

Interim standards for certain mineral constituents have been adopted by the California State Board of Public Health. Based on these standards, temporary permits may be issued in California for drinking water supplies failing to meet the United States Public Health Service Drinking Water Standards, provided the mineral constituents shown in Table 14 are not exceeded.

TABLE 14

CALIFORNIA STATE BOARD OF PUBLIC HEALTH
INTERIM UPPER LIMITS OF TOTAL SOLIDS AND SELECTED MINERALS

	Permit	Temporary Permit
Total solids	500 (1000)1/	1500 ppm
Sulfates (SO_4)	250 (500)	600 ppm
Chlorides (Cl)	250 (500)	600 ppm
Magnesium (Mg)	125 (125)	150 ppm

1/ Numbers in parentheses are maximum permissible, to be used only where no other more suitable water is available in sufficient quantity for use in the system.

Criteria for Irrigation Water

Criteria for the mineral quality of irrigation water have been developed by the Regional Salinity Laboratories of the United States Department of Agriculture in cooperation with the University of California. Because of diverse climatological conditions and the variation in crops and soils in California, only general limits of quality for irrigation water can be suggested. The Department uses three broad classifications for irrigation water:

Class 1 - Regarded as safe and suitable for most plants under most conditions of soil and climate.

Class 2 - Regarded as possibly harmful for certain crops under certain conditions of soil or climate, particularly in the higher ranges of this class.

Class 3 - Regarded as probably harmful to most crops and unsatisfactory for all but the most tolerant.

Limiting concentrations of chemical constituents in irrigation water as classified are shown in Table 15.

TABLE 15

QUALITATIVE CLASSIFICATION OF IRRIGATION WATER

Chemical Properties	Class 1 Excellent to Good	Class 2 Good to Injurious	Class 3 Injurious to Unsatisfactory
Total dissolved solids, in ppm	Less than 700	700 - 2000	More than 2000
Conductance, in micromhos at 25°C	Less than 1000	1000 - 3000	More than 3000
Chlorides, in ppm	Less than 175	175 - 350	More than 350
Sodium, in percent of base constituents	Less than 60	60 - 75	More than 75
Boron, in ppm	Less than 0.5	0.5 - 2.0	More than 2.0

The criteria for irrigation water have limitations in actual practice. In many instances, water of a given quality may be wholly unsuitable for irrigation under certain conditions of use, yet be completely satisfactory under other circumstances. Soil permeability, drainage, temperature, humidity, rainfall, and other conditions can alter the response of a certain crop to a particular quality of water.

Criteria for Industrial Uses

Water quality criteria for industrial water are as varied and diversified as industry itself. For example, food processing, beverage production, pulp and paper manufacturing, and textile industries have exacting requirements, while cooling or metallurgical operations permit the use of poor quality water. In general, where a water supply meets drinking water standards it is satisfactory for industrial use, either directly or following a limited amount of treatment by the industry.

Hardness

Even though hardness in water has not been included as a criteria for water quality, it is an important consideration in determination of suitability for domestic and industrial use. When water with excessive hardness is used for domestic purposes more soap is required and a scale develops in the pipes and fixtures. The values for the degree of hardness in water as shown in Table 16 are those suggested by the State Department of Water Resources.

TABLE 16

HARDNESS CLASSIFICATION

Range of hardness, expressed as $CaCO_3$ in ppm	Relative classification
0 - 100	Soft
101 - 200	Moderately hard
Greater than 200	Very hard

Bacteriological Criteria

Bacteriological examination of domestic water, by estimating bacterial density, is considered to be of significant value in appraising sanitary water quality. Although not pathogenic or disease-producing in itself, the coliform group of bacteria is invariably found in large numbers in soil and in the feces of man and warm blooded animals. The specific disease-producing organisms present in water are not easily identified, and the techniques for comprehensive bacteriological examination are complex and time consuming. For these reasons, coliform concentrations are used widely as an index of the bacteriological quality of water.

The United States Public Health Service has established bacteriological standards for drinking water, based on limits for the mean concentration of coliform bacteria in a series of water samples and the frequency at which concentrations may exceed the mean. Results are expressed as the "most probable number" (MPN) of coliform bacteria per 100 milliliters (ml) of sample. The recommended standards for domestic water delivered to the consumer are roughly equivalent to restricting the coliform concentration to not more than one organism for each 100 ml of water.

For fresh-water bathing and other water-contact sports, a coliform count of 1,000 MPN per 100 ml is used as a standard in several states and has been proposed as a recommended limit in California. This figure has been used as an ocean-water contact-sports standard for a number of years.

Preservation and Protection of Fish and Wildlife

A healthy and diversified aquatic population is indicative of good water quality conditions which in turn permit optimum benefical uses of the water. For such a population to exist, the environment must be suitable for both the fish and the food chain organisms.

Many mineral and organic substances in low concentrations are harmful to fish and aquatic life. Insecticides, herbicides, ether soluble materials, and salts of heavy metals are of particular concern.

Tolerances to temperature extremes vary widely between fish and species. In general, cold water fish are found in waters of from 32°F to 65°F. The maximum temperature for successful salmon spawning is 58°F. Rapid changes in water temperature may result in fish kills.

The minimum requirements for dissolved oxygen concentrations vary with the location and season. In general, 5 ppm is satisfactory for migrating fish, however, anadromous fish require at least 7 ppm dissolved oxygen in spawning areas and, under some conditions, 9 ppm is needed.

It has been found that pH limits of 7.0 to 8.5 provide satisfactory protection for fish.

The combined effect of any chemical or physical characteristics are not the simple sum of the specific effects. For example, while the hardness of the water does not of itself affect the fish, some insecticides are more toxic in soft water and others are more toxic in hard water. These problems of synergistic and antagonistic effects extend through a wide range of materials and conditions. Frequently, determination of the effects of a particular waste discharge is dependent upon biological studies in similar waters receiving similar wastes. In many cases, these requirements for similarity may not be met and laboratory bioassays are necessary.

Silt pollution and high turbidity are damaging to trout and salmon resources. Silt smothers important food-web organisms and fish eggs. Spawning beds, riffle areas and deep shelter pools can be eliminated by silt. In many serious cases, the problem is not obvious to the casual observer.

The minimum requirements placed on discharges concerning silt and turbidity have essentially been:

1. The discharge of sewage or industrial wastes, including agricultural waste, shall not increase the turbidity of the receiving waters by more than ten percent of the turbidity

value of the receiving waters immediately above the point of discharge.

2. Industrial or agricultural operations shall be conducted in such a manner that soil or any solid debris is not placed in or adjacent to streams where it will be subject to erosion by the receiving waters or runoff waters flowing into the stream.

CHAPTER VII. PRESENT SURFACE WATER QUALITY

The Russian River watershed is composed of 11 hydrographic subunits: Coyote Valley, Forsythe Creek, Upper Russian River, Sulphur Creek, Middle Russian River, Santa Rosa, Laguna, Mark West, Dry Creek, Austin Creek, and Lower Russian River. The subunits are shown on Plate 3.

The physical and chemical characteristics of the surface water in the watershed and in each of the subunits are evaluated in this chapter. The bacteriological quality of the surface water is evaluated in terms of the concentrations of coliform organisms. The aquatic biology of the watershed, particularly that of the Lower Russian River, and the effects of impoundments on surface water are discussed.

Sampling Technique

From July 1965 to August 1966, surface water samples were taken from 40 stations on the Russian River and its tributaries to determine the physical and chemical characteristics of the surface water. Field determinations were made for hydrogen ion concentration (pH), electrical conductivity (Ec or specific conductance), dissolved oxygen concentration (DO), temperature, alkalinity, and turbidity. The stations are shown on Plate 3.

Turbidity was determined by two methods. A Hach "Portable Engineers Laboratory" was used to determine turbidity in Jackson Turbidity Units (JTU). This is referred to as "Hach turbidity" in this report. A Hellige "Turbidimeter" was used to determine turbidity in APHA Turbidity Units (as ppm SiO_2). This is referred to as "Hellige turbidity" in this report. An effort was made to correlate the results from the two methods of turbidity determination but this was unsuccessful.

Samples were sent to the Department of Water Resources' Bryte Laboratory for various chemical analyses. Most analyses were made to determine concentration of specific parameters of quality for domestic and irrigation use. Standard mineral analyses were performed on at least one sample from each station. Samples were analyzed for these constituents: calcium (Ca), magnesium (Mg), sodium (Na), potassium (K), carbonate (CO_3), bicarbonate (HCO_3), sulfate (SO_4), chloride (Cl), nitrate (NO_3), fluoride (F), boron (B), silica (SiO_2), hardness, pH, total dissolved solids, and percent sodium. Results of the chemical analyses are presented in Appendix C.

Physical and Chemical Characteristics

The physical and chemical characteristics of surface water in the hydrographic subunits were determined from analyses performed on samples from stations within the respective subunits. Data from four stations along the length of the Russian River were used to evaluate the general physical and chemical characteristics of surface water in the entire watershed.

General Characteristics

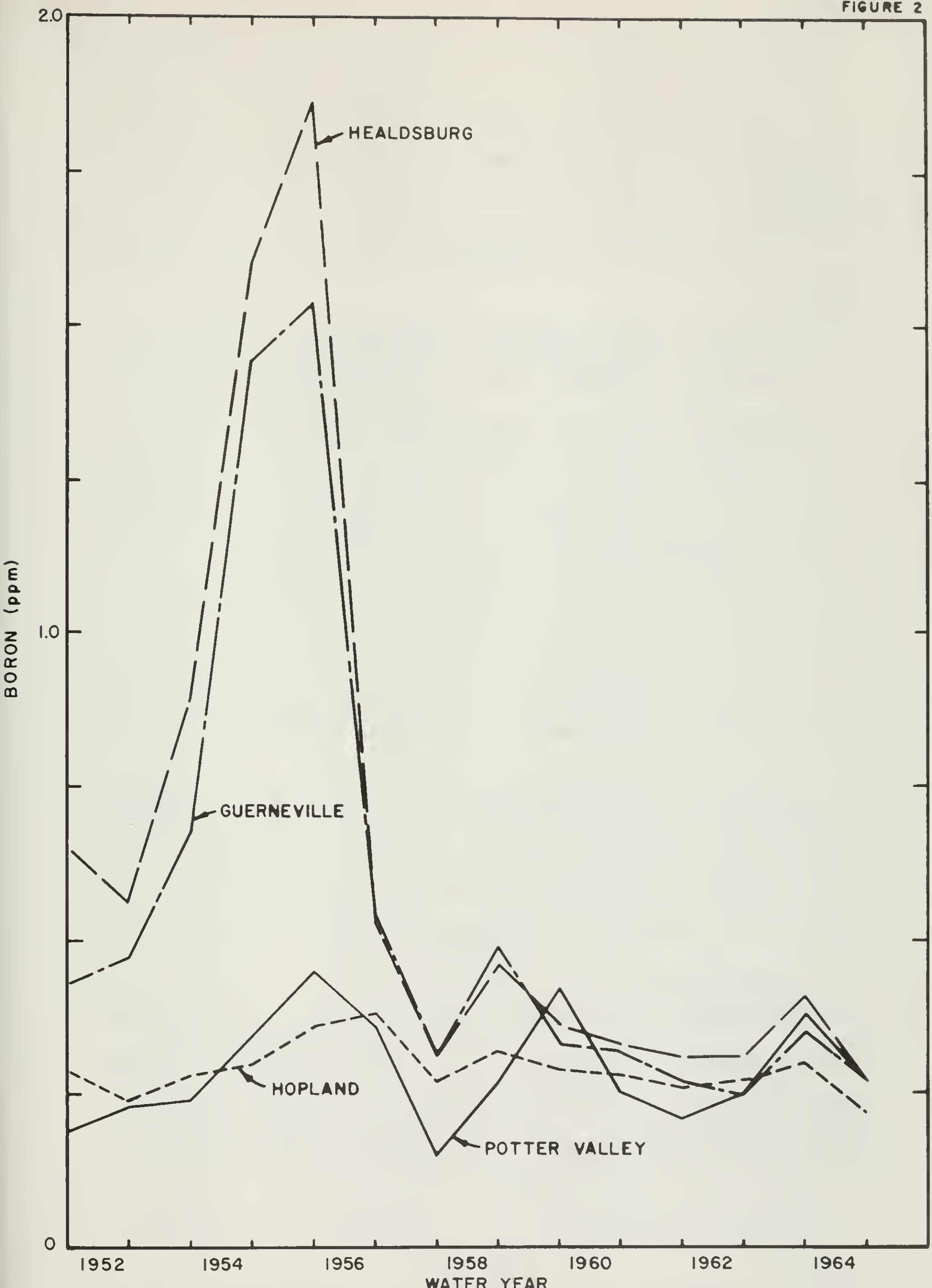
Generally, the surface water in the Russian River watershed is of excellent quality. Water samples from the sampling station on the Russian River at Guerneville reflect the quality of the drainage from all of the hydrologic subunits except Austin Creek. Chemical analyses for the Guerneville station are available on a monthly basis from 1951 to the present. During this period, the specific conductance of the river ranged from 82 to 381 micromhos and percent sodium ranged from 11 to 23. The water was generally moderately hard (average 116 ppm as $CaCO_3$). It was Class 1 (excellent to good) irrigation water with respect to all parameters except boron concentration. Prior to 1958, boron concentrations as high as 3 ppm were recorded during the summer periods of low flow. All recorded concentrations of boron have been less than the upper limit for Class 1 irrigation water (0.5 ppm) since 1958, when releases from Coyote Dam commenced.

Since 1951, chemical analyses have been performed on samples taken at three other stations: East Fork Russian River at Potter Valley, Russian River near Hopland, Russian River near Healdsburg. These analyses furnish valuable background data for the watershed.

The average yearly specific conductance values were plotted for each water year, 1951-52 to 1964-65, for the four stations on the Russian River. The curves are presented on Figure 1. The curves indicate that the Russian River is similar to almost all natural watercourses with mineral content increasing as the distance from the source increases. This is due to leaching of minerals from the riverbed, seepages of highly mineralized ground water, and waste water discharges into the river and its tributaries. The curves also indicate that no significant mineral degradation of the Russian River has occurred since 1951.

The average yearly boron concentrations for the four stations on the Russian River from water year 1951-52 to 1964-65 are presented on Figure 2. High boron concentrations are shown prior to 1958, particularly at Guerneville and Healdsburg. These were attributed to the operation of a dry ice manufacturing plant located between Hopland and Healdsburg. This plant, which was closed in 1956, discharged a highly mineralized waste to the Russian River. High boron concentrations, subsequent to 1956, were probably the result of seepage of mineralized water into the river during low flow periods. Since 1958, these concentrations have been lowered by dilution, due to releases of water stored by Coyote Dam.

AVERAGE YEARLY ELECTRICAL CONDUCTIVITY
AT FOUR STATIONS ON THE RUSSIAN RIVER

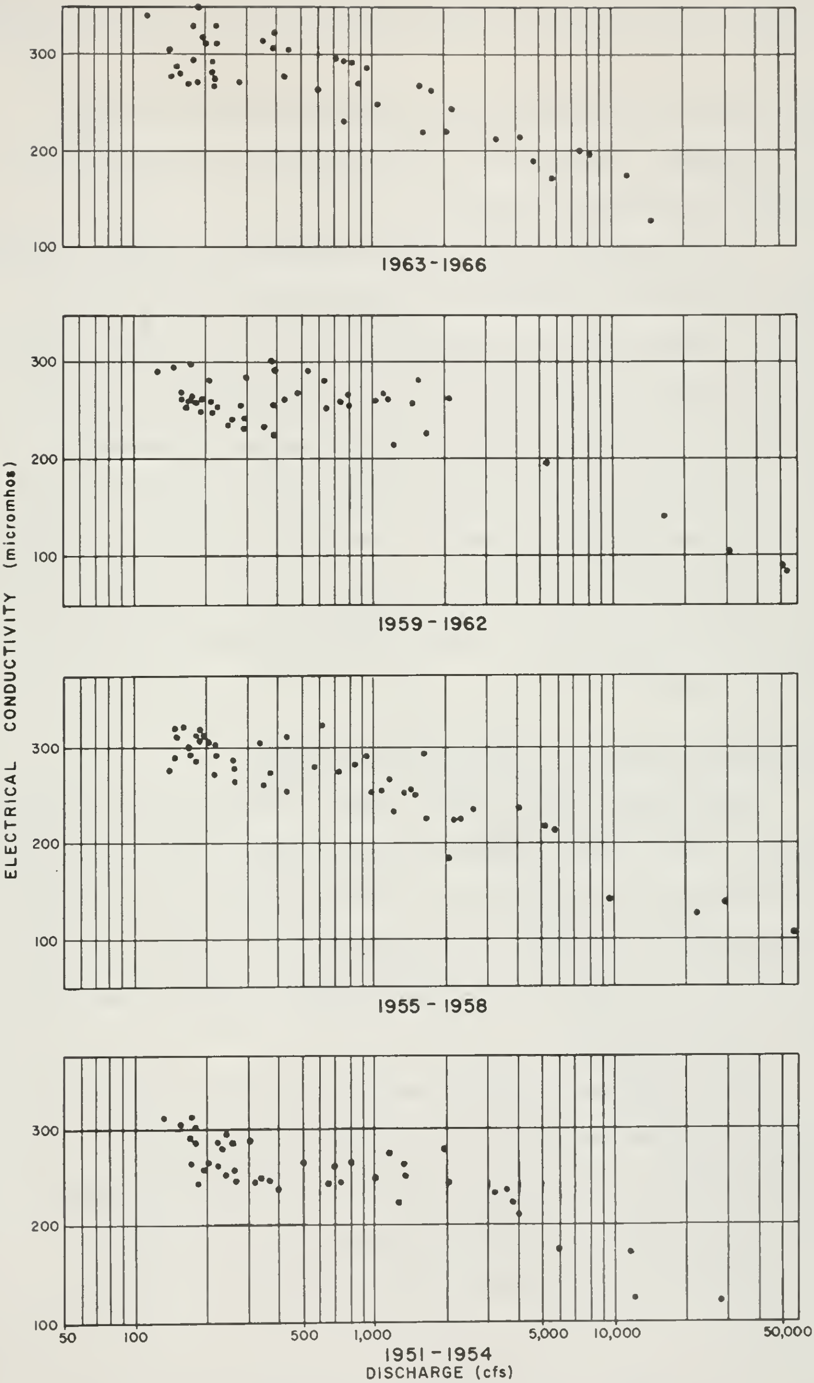


AVERAGE YEARLY BORON CONCENTRATIONS
AT FOUR STATIONS ON THE RUSSIAN RIVER

High dissolved iron concentrations were present in most surface water during the summer months. During the investigation, total iron concentrations ranging from 0.0 to 6.8 ppm (as Fe) were recorded in surface water throughout the watershed. The iron concentrations are attributed to two sources:

1. During the summer months when Lake Mendocino stratifies, anaerobic conditions develop in the lower depths. Under anaerobic conditions, insoluble ferric oxide from bottom sediments is reduced to the soluble ferrous iron. The fixed outlet at Coyote Dam then releases the water containing high iron concentrations to the East Fork Russian River.
2. Some species of algae can assimilate iron in the insoluble ferric state from bottom deposits. Within the algal cells, the iron is reduced to the soluble ferrous state. When the algae die, the ferrous iron is released into the water.

Specific conductance values were plotted against corresponding flows for the Russian River at Guerneville to determine any fluctuations in mineral quality with respect to flow. The plots were made for two four-year periods immediately preceding the completion of Coyote Dam and for two four-year periods after completion of the dam. The plotted points appearing on Figure 3 are generally typical of natural watercourses with decreasing specific conductance values (directly proportional to mineral content) at higher flows. No significant mineral quality changes were apparent after releases from Coyote Dam commenced. Plates 4 and 5



SPECIFIC CONDUCTANCE VERSUS DISCHARGE

RUSSIAN RIVER AT GUERNEVILLE

summarize data obtained during the investigation concerning the water quality throughout the watershed in terms of specific conductance values and flows during wet and dry weather.

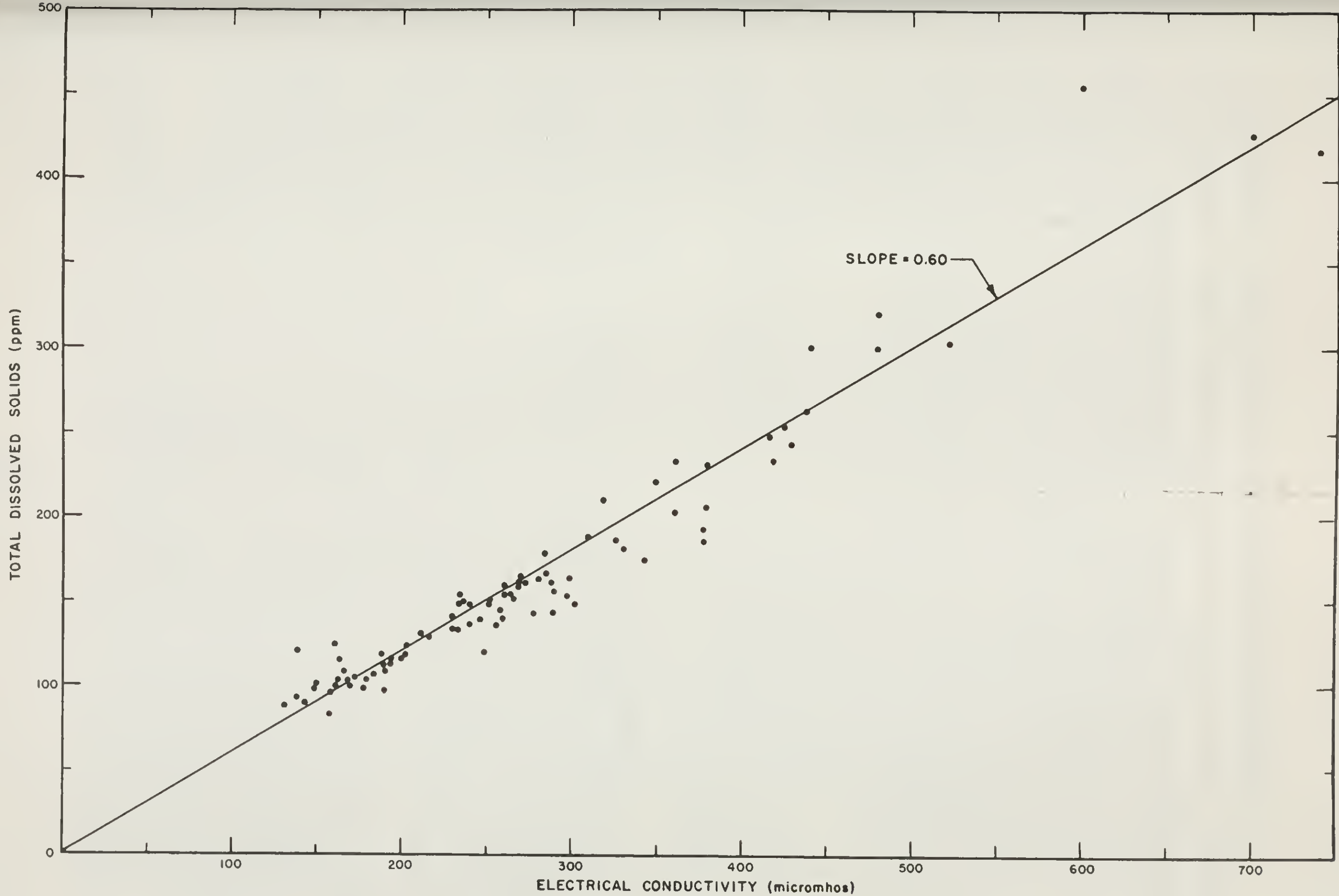
The relationship between specific conductance and total dissolved solids concentration was determined for surface water in the watershed. All specific conductance values obtained from all of the sampling stations were plotted against the corresponding total dissolved solids concentrations (Figure 4). The line of best fit was determined by regression analysis. The slope of the line and, therefore, the ratio of total dissolved solids concentration to specific conductance, was 0.6. For example, a specific conductance value of 300 micromhos in the Russian River watershed would be roughly equivalent to a total dissolved solids concentration of $0.6 \times 300 = 180$ ppm.

Specific Characteristics of Surface Water in Subunits

Coyote Valley Subunit. This subunit is located in the northeastern corner of the watershed. Lake Mendocino is located within this subunit and the principal streams are the East Fork Russian River and Cold Creek. Most of the water in the subunit is imported from the Eel River through the Potter Valley Powerhouse. From the powerhouse, the water flows into the East Fork Russian River.

The subunit was sampled at Cold Creek, and at the East Fork Russian River stations at Potter Valley and above Lake Mendocino. Instantaneous flows at the gaging station above Lake Mendocino ranged from 44 to 115 cfs when that station was sampled. Flows through the tailrace at Potter Valley ranged from 126 to 310 cfs.

FIGURE 4



TOTAL DISSOLVED SOLIDS CONCENTRATION VERSUS ELECTRICAL CONDUCTIVITY

RUSSIAN RIVER WATERSHED

The water was bicarbonate in type with calcium the predominant cation. It was of excellent quality and tested as Class 1 irrigation water with respect to all parameters except occasional high boron concentrations. One boron concentration of 0.6 ppm was recorded at Potter Valley during the investigation. Total dissolved solids concentrations ranged from 84 to 186 ppm and hardness ranged from 55 to 174 ppm as $CaCO_3$. High concentrations of iron (0.01 to 2.0 ppm) and manganese (0.08 to 0.14 ppm) were recorded in the East Fork Russian River above Lake Mendocino. Values of pH ranged from 7.3 to 8.5. Hach turbidities ranged from less than 5 to 275 JTU. The highest values occurred during periods of high runoff.

Dissolved oxygen saturation ranged from 85.5 to 120 percent at temperatures ranging from 42 to 72°F. Temperatures were generally too cold for water contact sports. However, some swimming activity was observed during midsummer.

Forsythe Creek Subunit. Forsythe Creek hydrologic subunit is located in the northwestern corner of the watershed. The principal stream is Forsythe Creek. Walker Creek, Mill Creek, and Seward Creek are tributary to Forsythe Creek.

The subunit was sampled at Forsythe Creek where estimated instantaneous flows ranged from 0.25 to 45 cfs.

The water was bicarbonate in type with calcium the predominant cation. The quality of the water was excellent. It was Class 1 irrigation water with respect to all parameters. Total dissolved solids ranged from 99 to 164 ppm and hardness from 64 to 144 ppm as $CaCO_3$. The highest recorded boron concentration during the investigation was 0.2 ppm.

Dissolved oxygen saturations ranged from 54.1 to 107 percent at temperatures ranging from 45 to 82°F. Values of pH ranged from 7.1 to 8.3.

Hach turbidities ranged from less than 5 to 55 JTU. The higher values occurred during periods of high runoff.

Upper Russian River Subunit. The Ukiah and Sanel valleys are in this subunit which is almost entirely within Mendocino County. The principal streams are the Russian River, York Creek, East Fork Russian River, Orrs Creek, Robinson Creek, McNab Creek, Feliz Creek, Sulphur Creek, Cummisky Creek, and Pieta Creek. The subunit receives drainage from Forsythe Creek and Coyote Valley subunits. The City of Ukiah discharges waste water effluent into the Russian River during periods of high flows.

Each of the streams was sampled at one or more stations. Instantaneous flows in various streams in the subunit ranged from 0 in Pieta, Feliz, Robinson, and Orrs creeks to 868 cfs in the Russian River at the Hopland gage.

The quality of water in all of the streams except Sulphur Creek was excellent. It was bicarbonate in type with calcium and magnesium the predominant cations. Concentrations of total dissolved solids ranged from 90 to 232 ppm and hardness ranged from 61 to 200 ppm as $CaCO_3$. With the exception of Sulphur Creek, all streams in the subunit produced Class 1 irrigation water with respect to all parameters.

High concentration of iron were recorded in the East Fork Russian River below Lake Mendocino (0-3.5 ppm), York Creek (0.15-0.57 ppm), and Sulphur Creek (0.02-0.67 ppm). Manganese concentrations ranging from 0.32 to 0.47 ppm were recorded in the East Fork Russian River below Lake Mendocino.

Sulphur Creek contained highly mineralized water from Vichy Springs. Water from one of these springs contained 81 percent sodium, 118 ppm boron, 3,270 ppm total dissolved solids, and had 472 ppm hardness as $CaCO_3$. Table 17 presents the high values of certain water quality parameters that were recorded in Sulphur Creek upstream and downstream from Vichy Springs.

TABLE 17

THE INFLUENCE OF VICHY SPRINGS ON CERTAIN PARAMETERS IN SULPHUR CREEK

Parameter	Value	
	Upstream From Vichy Springs	Downstream From Vichy Springs
Chloride (ppm)	24	107
Percent Sodium (%)	32	83
Total Dissolved Solids (ppm)	426	769
Specific Conductance (micromhos)	710	1,750
Boron (ppm)	9.9	49
Hardness (ppm as $CaCO_3$)	250	160

Upstream from Vichy Springs, Sulphur Creek contained calcium-sodium bicarbonate water. Downstream from Vichy Springs, the water was sodium bicarbonate. Fortunately, the maximum flow in Sulphur Creek is only about 8-10 cfs. Because the mineralized water is diluted as it flows into the Russian River, discharge from this creek does not create objectionable concentrations of water quality parameters in the river.

Dissolved oxygen saturations in the subunit ranged from 86.1 to 160 percent. Field determinations of pH ranged from 6.7 to 8.9. Hach turbidities ranged from less than 5 to 375 JTU. The highest values occurred during periods of maximum runoff, usually in the Russian River.

Temperatures ranged from 39 to 90°F. Generally, the water in the Russian River and larger tributaries was too cold for water-contact sports.

Sulphur Creek Subunit. Sulphur Creek subunit straddles the Mendocino-Sonoma County boundary. Its principal streams are Big Sulphur Creek and Little Sulphur Creek.

Water samples were taken at three stations on Big Sulphur Creek and at one station on Little Sulphur Creek. Instantaneous flows at the gaging station on Big Sulphur Creek ranged from 4.2 to 90 cfs.

The water was bicarbonate in type with calcium and magnesium the predominant cations. It was of excellent quality with respect to all parameters except boron concentration. Total dissolved solids ranged from 98 to 300 ppm and hardness ranged from 93 to 300 ppm as $CaCO_3$.

Highly mineralized water, containing high concentrations of boron, flows into Big Sulphur Creek from hot springs and steam vents at The Geysers. The geothermal power plant at The Geysers utilizes natural steam from wells to produce electrical power. Condensed water from this operation is mixed with water from Big Sulphur Creek and then discharged into the creek.

The highest boron concentration recorded in Big Sulphur Creek, upstream from The Geysers, was 0.5 ppm. At The Geysers Road Bridge, over the creek some six miles downstream from The Geysers, boron concentrations as high as 6.4 ppm were recorded. Therefore, the water was classified as Class 3 (injurious to unsatisfactory) irrigation water. At the gaging station on Big Sulphur Creek, a high boron concentration of 2.3 ppm was recorded. The boron concentrations at the gage were lower than those at the bridge due to dilution from Little Sulphur Creek (maximum recorded boron concentration 0.1 ppm).

Dissolved oxygen saturations ranged from 70.5 to 128 percent at temperatures from 38.5 to 78°F. Values of pH, determined in the field, ranged from 7.7 to 8.9. Hach turbidities ranged from less than 5 to 8 JTU. The very low values are attributed to the lack of turbidity-causing materials in the rocky creekbed and banks.

Middle Russian River Subunit. This subunit is northeast of Healdsburg in the northeastern portion of Sonoma County. The principal streams are Ash Creek, the Russian River, Franz Creek, Sausal Creek, and Maacama Creek. The subunit receives drainage from the Upper Russian River and Sulphur Creek subunits.

All of the major streams in the subunit were sampled. The Russian River was sampled at three stations: north of Cloverdale, at Cloverdale, and at the gaging station near Healdsburg. Instantaneous flows at the gage on the Russian River near Healdsburg ranged from 15 to 1,420 cfs.

Surface water in the subunit was bicarbonate type with calcium and magnesium the predominant cations. The water was of excellent quality with concentrations of all parameters below the limit for Class 1 irrigation water. Total dissolved solids ranged from 113 to 206 ppm and hardness ranged from 43 to 180 ppm as $CaCO_3$.

Boron concentrations as high as 2.3 ppm (Class 3 irrigation water) were discharged into the Russian River from the Sulphur Creek subunit. Boron concentrations were monitored upstream and downstream from the confluence of Big Sulphur Creek, from the sampling stations on the Russian River north of Cloverdale, and at Cloverdale. This monitoring program indicated that the high boron concentrations in the discharge from the Sulphur Creek subunit were diluted by the Russian River to a level acceptable for Class 1 irrigation water. Boron concentrations in the remainder of the subunit ranged from 0 to 0.5 ppm.

Dissolved oxygen saturation ranged from 63.4 to 124 percent. Field determinations of pH in the subunit ranged from 7.1 to 8.8. Hach turbidities ranged from less than 5 to 91 JTU. The higher values occurred in the Russian River during periods of high runoff.

Temperatures at Healdsburg ranged from 41 to 78°F. During the summer months, the water was warm enough for swimming and other water-contact sports.

Santa Rosa Subunit. The Santa Rosa subunit is located south of the Mark West subunit, northeast of the Laguna subunit, and along the Sonoma-Napa County line. Most of the City of Santa Rosa is within the subunit which receives most of the waste water discharged from this city. The major streams in the subunit are Santa Rosa Creek and a tributary, Malanzas Creek.

Santa Rosa Creek was sampled at Melita, upstream from all waste water discharges, and at Willowside Road, downstream from the waste water discharges. During the summer months, about 95 percent of the flow at Willowside Road is composed of sewage effluents.

The quality of the water at the two sampling stations was quite different. Water at Melita was calcium-magnesium bicarbonate, while water at Willowside Road was sodium-magnesium bicarbonate. The water was Class 1 irrigation water with respect to all parameters at Melita, but contained concentrations of parameters that often rendered it Class 2 (good to injurious) irrigation water at Willowside Road. The range of recorded values of selected water quality parameters at the two stations are shown in Table 18.

TABLE 18

EFFECT OF WASTE WATER DISCHARGES ON SANTA ROSA CREEK

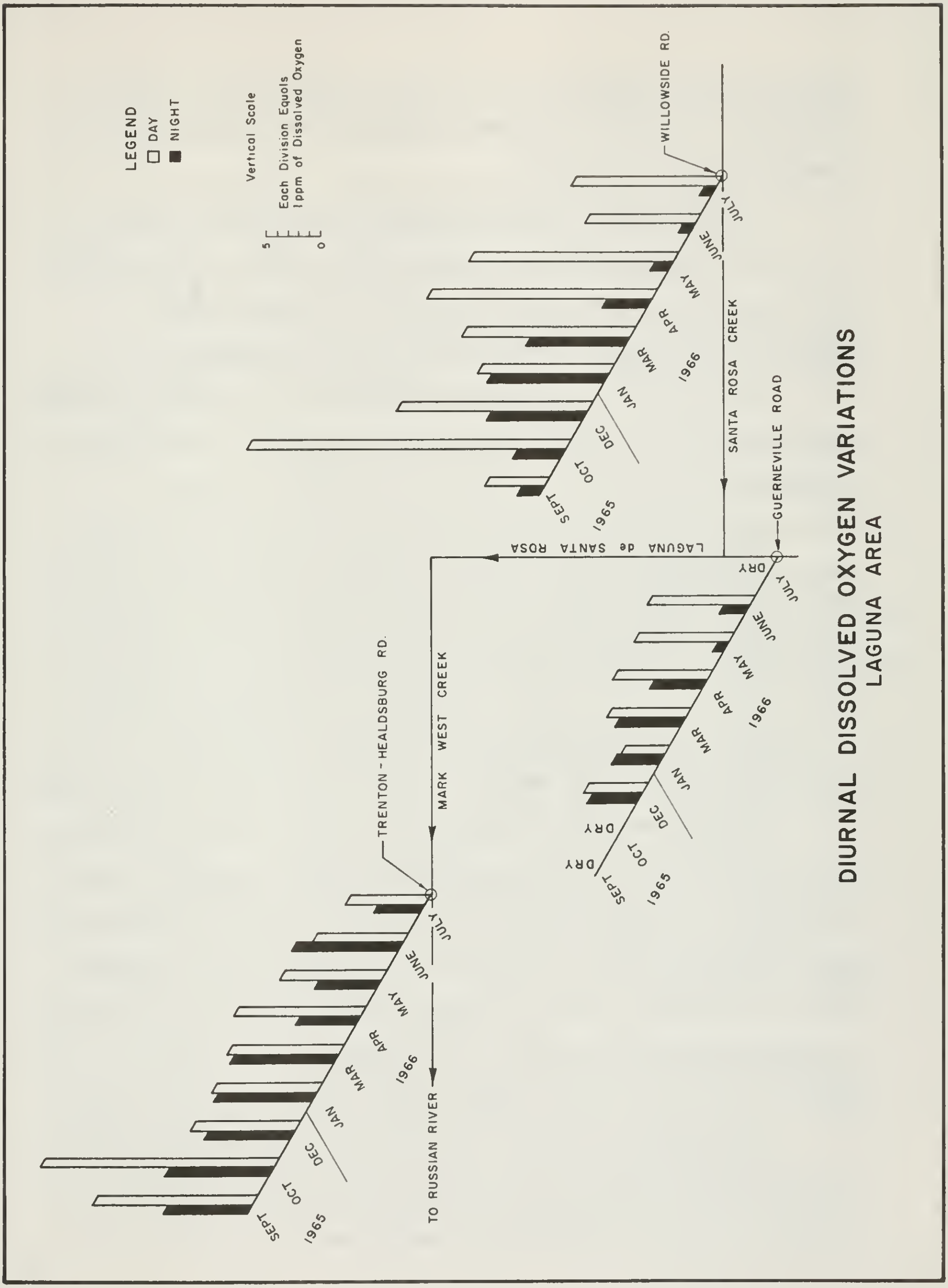
Parameter	Recorded Range	
	Melita	Willowside Road
Chloride (ppm)	6.2-12	27-105
Percent Sodium (%)	16	42-46
Specific Conductance (µmhos)	285-439	425-1130
Total Dissolved Solids (ppm)	178-264	254-500
Boron (ppm)	0.2-0.3	0.1-0.6

High concentrations of nutrients (mostly nitrogen and phosphorous) and high temperatures stimulate abundant phytoplankton (mostly unattached algae) growths during the summer months. Most of the nitrogen occurred as nitrates. The maximum recorded nitrate concentration at Willowside Road was 64 ppm while at Melita it was 4.7 ppm (as NO_3). Most of the phosphorous occurred as orthophosphate. Orthophosphate concentrations as high as 22 ppm (as PO_4) were recorded at Willowside Road. The highest orthophosphate concentration recorded at Melita was 0.32 ppm.

The extent of phytoplankton growth in Santa Rosa Creek at Willowside Road can be shown by the high dissolved oxygen saturations and by diurnal fluctuations of dissolved oxygen and pH. The dissolved oxygen saturation ranged from 11.5 percent in the early morning to 351 percent in the late afternoon. The diurnal fluctuations in dissolved oxygen concentration for Santa Rosa Creek at Willowside Road, Mark West Creek at Trenton-Healdsburg Road, and the Laguna de Santa Rosa near Graton are shown in Figure 5.

Diurnal fluctuations in dissolved oxygen concentration and pH are due to the respiratory habits of algae. During the daylight hours, algae consume carbon dioxide (CO_2) and release oxygen (O_2) to the water. This results in high pH values and high concentrations of dissolved

FIGURE 5



DIURNAL DISSOLVED OXYGEN VARIATIONS
LAGUNA AREA

oxygen. At night, when there is no sunlight, algae consume oxygen and release CO_2 to the water, lowering the pH values and the concentration of dissolved oxygen in the water.

Temperatures in Santa Rosa Creek ranged from 40 to 95°F. The warm temperatures stimulate phytoplankton growth. They can be attributed to slow sluggish movement of the stream and the discharge from the relatively warm oxidation ponds owned by the City of Santa Rosa.

Hach turbidities ranged from less than 5 to 180 JTU. The higher values occurred at Willowside Road and were attributed to phytoplankton in the water.

Laguna Subunit. The Laguna subunit is located south of Santa Rosa, north of Cotati, and east of Sebastopol, the largest city in the Laguna subunit. The principal stream is the Laguna de Santa Rosa. The Laguna subunit is a low wet area with restricted drainage due to the flat gradient. The City of Sebastopol is the major waste water discharge in the subunit. The Laguna receives drainage from the Santa Rosa subunit.

Samples were taken from the Laguna de Santa Rosa at the gaging station near Graton just upstream of the confluence of Santa Rosa Creek. Instantaneous flows ranged from 0 to 12 cfs at the times of sampling. The Laguna de Santa Rosa was dry during the summer months. When water was present, the quality was good. It was calcium bicarbonate type and Class 1 irrigation water with respect to all parameters. Total dissolved solids ranged from 150 to 210 ppm. Hardness ranged from 73 to 172 ppm as $CaCO_3$.

High nutrient concentrations resulted in phytoplankton growths and consequential high DO saturations and diurnal DO and pH fluctuations. Dissolved oxygen pH fluctuations were not as extreme as those in Santa

Rosa Creek. Field determinations of pH ranged from 6.9 to 7.6 and DO saturation ranged from 11.4 percent in the early morning to 214 percent in the late afternoon. Nutrient concentrations were also lower than in Santa Rosa Creek. Nitrate concentrations ranged from 2.0 to 9.6 ppm and orthophosphate concentrations ranged from 4.0 to 7.9 ppm.

Hach turbidities were high, ranging from 40 to 112 JTU. This was largely attributed to algae in the water. Temperatures ranged from 39.5 to 72°F.

Mark West Subunit. This subunit is entirely within Sonoma County and is located north of the Santa Rosa area. It is bounded on the east by the Napa County line. The major streams in the subunit are Mark West Creek and its tributary, Windsor Creek. The subunit receives drainage from the Santa Rosa and Laguna subunits. The largest waste water discharge in the subunit is the City of Windsor.

Surface water in this subunit was sampled at two stations: Mark West Creek at Fulton, upstream from the waste water discharges and from the confluence of the Laguna and Santa Rosa creeks, and Mark West Creek at Trenton-Healdsburg Road, downstream from most of the waste water discharges in the Santa Rosa plain. Estimated instantaneous flows at Trenton-Healdsburg Road ranged from 3 to 40 cfs, and at Fulton flows ranged from 0.5 to 25 cfs at the times of sampling.

Generally, water quality conditions were similar to those in the Santa Rosa subunit. Surface water at Fulton was of excellent quality and calcium-magnesium bicarbonate. It was Class 1 irrigation water with respect to all parameters. Total dissolved solids ranged from 125 to

224 ppm, hardness from 74 to 160 ppm (as $CaCO_3$), and boron from 0.1 to 0.4 ppm. One determination of percent sodium indicated a value of 19 percent.

The water at Trenton-Healdsburg Road was borderline between Class 1 and Class 2 irrigation water. Many parameters were present in amounts that would render it Class 2 irrigation water. Total dissolved solids ranged from 188 to 524 ppm, hardness from 110 to 241 ppm, and boron from 0.1 to 0.6 ppm. One determination for percent sodium indicated a value of 42 percent. Iron concentrations ranged from 1.2 to 5.6 ppm. Manganese concentrations ranged from 0.01 to 0.70 ppm.

Detergent surfactant concentrations, as alkyl benzene sulfonate (ABS), were determined at both stations to monitor the waste water reaching the stream. ABS concentrations ranged from 0.1 to 1.2 ppm at Trenton-Healdsburg Road. This indicated that substantial quantities of domestic sewage were reaching the creek. No ABS was detected at Fulton, indicating that no appreciable amounts of domestic sewage were being discharged to the creek further upstream.

Nitrate concentrations at Trenton-Healdsburg Road ranged from 0.9 to 56 ppm. At Fulton, nitrates ranged from 0.4 to 2.3 ppm.

Orthophosphate concentrations ranged from 4.5 to 22 ppm at Trenton-Healdsburg Road and from 0.12 to 0.21 ppm at Fulton.

The high nutrient concentrations at Trenton-Healdsburg Road resulted in excessive algal growths. These were evidenced by high DO saturations and diurnal DO and pH fluctuations (Figure 5). Dissolved oxygen saturation ranged from 44.8 percent in the early morning to 248 percent late in the afternoon. Field determinations of pH ranged from 7.3 in the morning to 9.4 in the afternoon.

Hach turbidities at Trenton-Healdsburg Road were high, due mostly to the algae in the water. They ranged from 18.5 to 170 JTU. At Fulton, Hach turbidities ranged from less than 5 to 17 JTU. The higher values occurred during periods of high runoff.

Temperatures at the two stations ranged from 39.5 to 83°F.

Dry Creek Subunit. Dry Creek subunit produced more runoff than any other subunit in the watershed. This subunit is located west of Cloverdale and Geyserville. Healdsburg, the only city in the subunit, contributes the only significant waste water discharge within the area.

Major streams in the subunit are Dry Creek, Warm Springs Creek and Mill Creek, which are tributary to Dry Creek. Cherry Creek, Pena Creek, and Wallace Creek are smaller tributaries to Dry Creek. Rancheria Creek is tributary to Warm Springs Creek.

The subunit was sampled at three locations: Dry Creek near Yorkville, Warm Springs Creek, and Dry Creek at the gaging station near Geyserville. Instantaneous discharge measured at the Dry Creek gage near Geyserville ranged from 1.2 to 394 cfs at the times of sampling. The peak flow measured at the gage was about 20,000 cfs in January 1966.

Water in the subunit was calcium-magnesium bicarbonate. It was of excellent quality except for some high boron concentrations found in Warm Springs Creek. Total dissolved solids ranged from 88 to 320 ppm, hardness from 57 to 125 ppm (as $CaCO_3$), and percent sodium from 17 to 34. Boron concentrations in Warm Springs Creek ranged from 0 to 2.3 ppm. Elsewhere in the subunit the range was from 0 to 0.3 ppm.

Dissolved oxygen saturation ranged from 71.3 to 155 percent at temperatures of 42.5 to 83°F. Field determinations of pH were recorded from 7.5 to 8.8. Hach turbidities ranged from less than 5 to 6.8 JTU. The high values occurred during periods of high runoff.

Austin Creek Subunit. This subunit drains into the Russian River a short distance from its outlet to the ocean. The principal streams are East Austin Creek, Big Austin Creek, and Ward Creek, all tributary to Austin Creek.

The subunit was sampled at Austin Creek near the confluence with the Russian River. Estimated instantaneous flows ranged from 0.5 to 75 cfs at the times of sampling.

The water was magnesium-calcium bicarbonate and of excellent quality. The stream yielded Class 1 irrigation water with respect to all parameters. Total dissolved solids ranged from 126 to 152 ppm and hardness ranged from 107 to 148 ppm.

Dissolved oxygen saturation ranged from 52.9 to 105 percent at temperatures from 45 to 68°F. Field determinations of pH ranged from 7.3 to 8.3. Hach turbidities ranged from less than 5 to 15 JTU. The highest values occurred during the highest runoff.

Lower Russian River Subunit. This subunit is bounded by the cities of Sebastopol and Healdsburg on the east, Dry Creek subunit on the north, and the Pacific Ocean on the west. The major streams are the Russian River, Green Valley Creek, Dutch Bill Creek, Atascadero Creek, and Purrington Creek. The subunit receives drainage from the Dry Creek, Austin Creek, Mark West, and Middle Russian River subunits. Waste water discharges in the subunit are from the City of Forestville and numerous apple processing plants into Green Valley Creek.

The subunit was sampled on the Russian River at Duncans Mills and Guerneville, and at Green Valley Creek. Instantaneous flows at the gaging station on the Russian River at Guerneville ranged from 154 to 3,200 cfs at the times of sampling.

Surface water was calcium-magnesium bicarbonate and was of excellent quality. Concentrations of all parameters were less than the upper limits for Class 1 irrigation water. Total dissolved solids ranged from 130 to 175 ppm, hardness from 86 to 193 ppm (as $CaCO_3$), boron from 0.1 to 0.4 ppm, and percent sodium from 14 to 23. Iron concentrations in the Russian River at Duncans Mills ranged from 0.67 to 1.4 ppm. Manganese concentrations in the Russian River at Duncans Mills ranged from 0 to 0.16 ppm.

Phytoplankton growths are approaching nuisance levels in many sections of the lower Russian River. Phytoplankton is transported into the Russian River from the Mark West Subunit and thrives on the high nutrient concentrations from the same source.

Dissolved oxygen saturation ranged from 83 to 129 percent in the Russian River and from 1 to 88.4 percent in Green Valley Creek. The low saturations in Green Valley Creek were probably due to biological oxidation of organic matter emanating from waste water discharges.

Field determinations of pH ranged from 6.9 to 8.2. Green Valley Creek consistently yielded the lower values. Temperatures ranged from 43.5 to 78°F.

Aquatic Biology

Aquatic biology of streams in the upper Russian River is typical of classic "clean water" zones with varied and diverse biological populations.

The outstanding biological problem within the watershed is due to phytoplankton growth in the lower Russian River. Phytoplankton is commonly defined as "plant microorganisms, such as certain algae, living unattached in the water"(22). Phytoplankton are present in the waters of the lower Russian River in such numbers that the water assumes a green color during the summer months. These conditions tend to discourage water contact sports and generally contribute to unesthetic conditions. If phytoplankton growths continue to increase, water-oriented recreation in the lower Russian River could greatly decline. This would have an adverse effect on the economy of Sonoma County.

The principal reason for excessive growths of phytoplankton is that nutrients (mostly nitrates and phosphates) from sewage treatment plant effluents are transported into the Russian River through the Mark West Creek system. The nutrient concentrations in the Russian River upstream from the confluence of Mark West Creek are not low enough to eliminate phytoplankton growth. However, their levels are not high enough to stimulate phytoplankton growth to nuisance levels as is the case downstream from the confluence of Mark West Creek. The warm water temperatures and bright sunlight of the summer months also tend to stimulate phytoplankton growth.

On July 19, 1966, nutrient analyses were performed on samples from the following locations: Russian River north of Cloverdale, Russian River at Healdsburg, Mark West Creek at Trenton-Healdsburg Road, Russian River at Guerneville, and Russian River at Duncans Mills. The results of these analyses are presented in Table 19. The analyses indicate that most of the phosphate in the Russian River is in the orthophosphate form. Also, the high nitrate and phosphate concentrations in the lower Russian River and in Mark West Creek are typical of concentrations found in waters receiving sewage effluents.

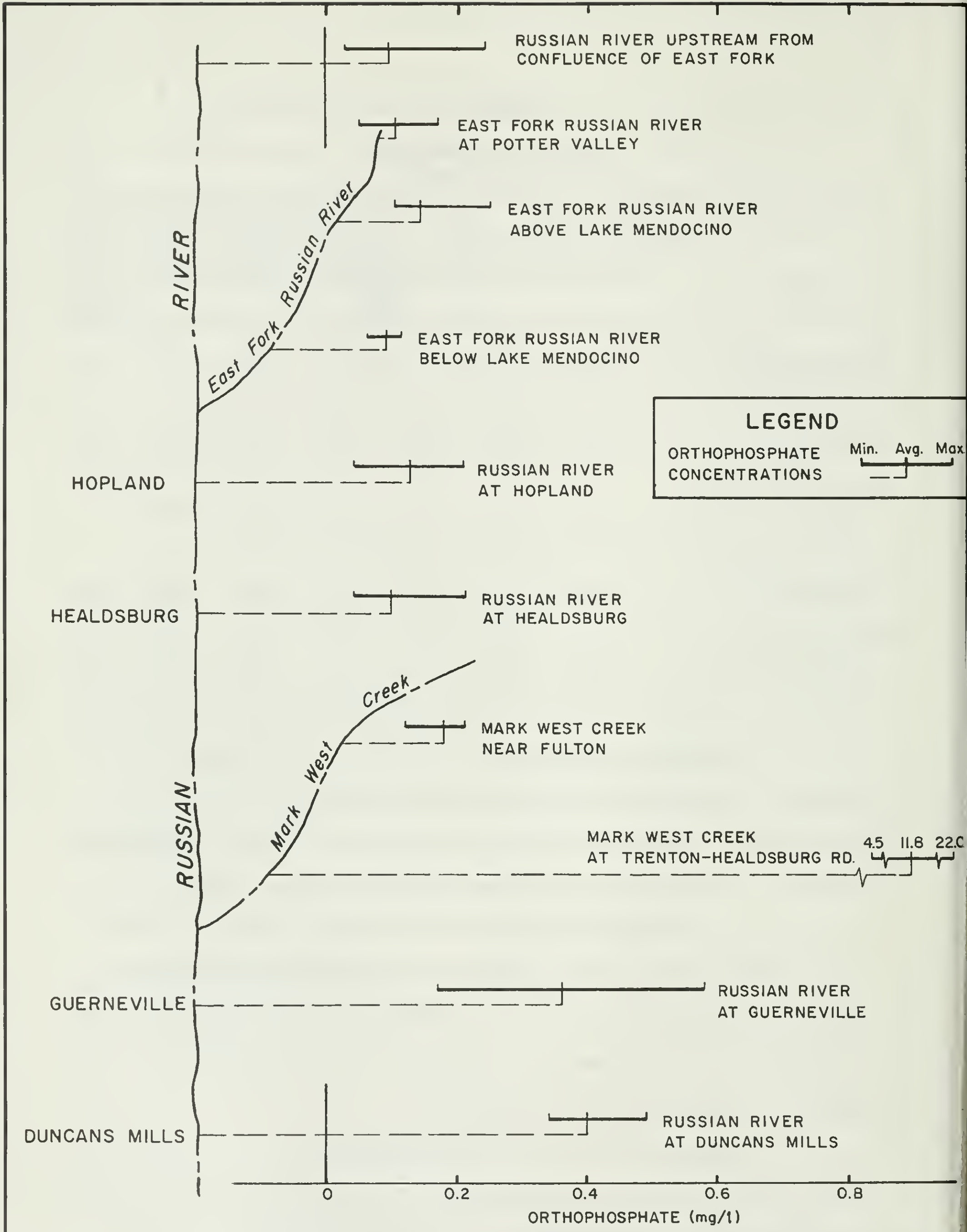
TABLE 19

NUTRIENT DETERMINATIONS
(August 19, 1966)

Station	NH_3 as N (ppm)	NO_2 as N (ppm)	NO_3 as N (ppm)	Organic Nitrogen as N (ppm)	PO_4 Ortho (ppm)	PO_4 Total (ppm)	PO_4 Total and Org. (ppm)
Russian River north of Cloverdale	0.02	0.00	0.0	0.1	0.05	0.06	0.11
Russian River at Healdsburg	0.01	0.00	0.0	0.2	0.10	0.10	0.12
Mark West Creek at Trenton-Healdsburg Road	8.8	0.19	0.3	2.4	26	26	26
Russian River at Guerneville	0.01	0.00	0.0	0.3	0.43	0.59	0.69
Russian River at Duncans Mills	0.00	0.00	0.0	0.3	0.32	0.35	0.45

Orthophosphate concentrations found in the Russian River system during the investigation are graphically illustrated on Figure 6. The orthophosphates from the Mark West Creek system increase the concentration downstream from the confluence by more than 100 percent. This is the principal reason for excessive phytoplankton growths in the lower Russian River. Table 20 shows phytoplankton concentrations upstream and downstream from Mark West Creek and also in Mark West Creek. The samples were collected on July 13, 1966. The average water temperatures for June, July, August, and September are also presented.

Prospects are that phosphate concentrations in the lower Russian River will increase and as a consequence there will be more extensive growth of phytoplankton. The discharge from the City of Santa Rosa's sewage treatment plant presently contains about 1,300 pounds of orthophosphates



ORTHOPHOSPHATE CONCENTRATIONS
RUSSIAN RIVER SYSTEM

per day. About 30 percent of this discharge, containing 390 pounds of orthophosphates per day, reaches the Russian River during the critical summer periods. This results in a mean orthophosphate concentration of 0.36 ppm in the Russian River at Guerneville, compared with a mean value of 0.10 ppm at Healdsburg upstream from the discharge. By 1980, if the existing waste disposal facilities are still in use, the projected volume of waste water discharged from the Santa Rosa Valley reaching the Russian River will be about 9 mgd.(32) Orthophosphates in this discharge will amount to 2,083 pounds per day. Assuming a summer flow of 200 cfs, this will result in an orthophosphate concentration of about 2 ppm in the lower Russian River, or a 455 percent increase over present levels.

TABLE 20

PHYTOPLANKTON POPULATION, LOWER RUSSIAN RIVER

Station	Algal Concentration(No./ml) Blue-Green	Diatom	Green	Mean Summer Daytime Temperature (°F)1/
Upstream from Mark West Creek	0	2030	190	74.0
Mark West Creek	60	1020	28560	74.7
Downstream from Mark West Creek	0	3240	820	73.2

1/ During monthly sampling period.

Bottom samples were taken at three stations: Mark West Creek near the confluence with the Russian River, and in the Russian River both upstream and downstream from the confluence of Mark West Creek. Samples were taken with a Surber sampler (1), which covers one square foot of bottom area. The results are presented in Table 21.

TABLE 21

BOTTOM FAUNA ANALYSES

Organism: Order) Unless / Family) Otherwise / Genus-Species) Noted	Stage	Number of Organisms Per Square Yard — Russian River Above the Confluence of Mark West Creek 7-13-66	8-23-66	9-30-66	Mark West Creek - 200 Yards Above Confluence with Russian River 7-13-66	8-23-66	9-30-66	Russian River - 500 Yards Below Confluence of Mark West Creek 7-13-66	8-23-66	9-30-66	Average of Three Sample Periods — Russian River Above Confluence	Mark West Creek	Russian River Below Confluence
Ephemeroptera (may flies)		65	4	34	--	--	--	67	8	162	34.3	--	79.0
Baetidae	Nymphs	--	4	34	--	--	--	--	--	--	12.7	--	--
Baetis	Nymphs	--	--	--	--	--	--	33	3	158	--	--	64.7
Tricorythodes	Nymphs	63	--	--	--	--	--	33	2	4	21.0	--	13.0
Ephemerella	Nymphs	--	--	--	--	--	--	1	--	--	--	--	0.3
Pseudocloeon	Nymphs	2	--	--	--	--	--	--	3	--	0.7	--	1.0
Trichoptera (caddis flies)		24	59	29	3	9	--	6	33	101	37.3	4.0	46.7
Hydropsychidae													
Hydropsyche	Larvae	12	17	25	3	9	--	3	24	94	18.0	4.0	40.3
	Pupae	--	--	--	--	--	--	--	1	4	--	--	1.7
Philopotamidae													
Dolophilodes	Larvae	--	36	1	--	--	--	--	6	1	12.1	--	2.3
Unidentified	Larvae	6	2	1	--	--	--	1	1	2	3.0	--	1.3
	Pupae	4	--	2	--	--	--	2	1	--	2.0	--	1.0
	Adults	2	4	--	--	--	--	--	--	--	2.0	--	--
Diptera		88	2	36	1,365	1,029	50,580	119	12	71	42.0	17,658	67.3
Simuliidae (black flies)	Larvae	--	2	8	438	462	39,000	3	4	43	3.3	13,300	16.7
	Pupae	--	--	--	231	393	3,150	--	--	--	--	1,258	--
	Adults	--	--	--	6	9	90	--	--	--	--	35.0	--
Tendipedidae (midges)	Larvae	70	--	26	600	141	7,950	102	6	26	32.0	2,897	44.7
	Pupae	10	--	2	51	21	390	6	1	2	4.0	154	3.0
	Adults	--	--	--	30	--	--	--	--	--	--	10.0	--
Tabanidae (horse flies)	Puparia	--	--	--	9	--	--	--	--	--	--	3.0	--
Rhagionidae (snipe flies)	Larvae	--	--	--	--	--	--	2	--	--	--	--	0.7
Unidentified	Larvae	5	--	--	--	--	--	--	1	--	1.7	--	0.3
	Pupae	3	--	--	--	--	--	6	--	--	1.0	--	2.0
Coleoptera (beetles)		--	--	1	--	3	--	5	4	6	0.3	1.0	5.0
Elmidae	Larvae	--	--	1	--	--	--	3	4	6	0.3	--	4.3
Hydrophilidae	Larvae	--	--	--	--	3	--	--	--	--	--	1.0	--
Unidentified	Larvae	--	--	--	--	--	--	2	--	--	--	--	0.7
Lepidoptera (aquatic caterpillars)		1	--	--	--	--	--	2	--	4	0.3	--	2.0
Pyralididae													
Elophila	Larvae	1	--	--	--	--	--	2	--	2	0.3	--	1.3
	Pupae	--	--	--	--	--	--	--	--	2	--	--	0.7
Amphipoda (scuds)		--	--	--	--	9	480	--	--	--	--	163	--
Talitridae													
Hyalella-azteca		--	--	--	--	9	480	--	--	--	--	163	--
Hemiptera		--	--	--	--	96	--	--	--	--	--	32.0	--
Corixidae (water boatmen)	Nymphs	--	--	--	--	60	--	--	--	--	--	20.0	--
	Adults	--	--	--	--	36	--	--	--	--	--	12.0	--
Annelida-phylum		1	4	--	27	18	--	--	--	--	1.7	15.0	--
Polychaeta-class		--	--	--	--	12	--	--	--	--	--	4.0	--
Neanthes-limnicola		--	--	--	6	--	--	--	--	--	--	2.0	--
Oligochaeta (aquatic earthworms)-Class		--	4	--	--	3	--	--	--	--	1.3	1.0	--
Hirudinea (leaches)-Class		--	--	--	--	3	--	--	--	--	--	1.0	--
Unidentified		--	--	--	21	--	--	--	--	--	--	7.0	--
Mollusca-phylum		--	--	--	--	--	--	--	--	--	--	--	--
Gastropoda-class		--	--	--	--	66	--	--	--	--	--	22.0	--
Snails		--	--	--	--	--	--	--	--	5	--	--	1.7
Pulmonata-order		--	--	--	--	--	--	--	--	--	--	--	--
Ancylidae (limpets)-family		--	--	--	--	--	--	--	--	33	--	--	11.0
Pelycepoda (clams)-Class		21	14	13	--	--	--	15	57	136	16.0	--	69.3
Corbicula		21	14	13	--	--	--	15	57	136	16.0	--	69.4

Organisms present but not enumerated — Hydracarina (water mites), Gastropoda (snails), Ancylidae (limpets)

Data shown in Table 21 indicate that the Russian River upstream and downstream from the confluence of Mark West Creek is typical of unpolluted natural watercourses with a diversity of bottom organisms and no one species dominant. However, Mark West Creek is typical of a polluted environment with some types of bottom organisms dominant (Diptera). The discharge from Mark West Creek had no significant adverse effects on the bottom environment.

Bacteriological Quality

Limited data are available regarding the bacteriological quality of surface water in the Russian River watershed, and what is available is based on coliform analyses. (See Chapter VI.)

As a part of the Department of Water Resources' bimonthly surface water sampling program, coliform analyses are performed on samples from four stations on the Russian River. These stations are located on the East Fork of the Russian River at Potter Valley, on the Russian River near Hopland, on the Russian River near Healdsburg, and on the Russian River at Guerneville. The City of Santa Rosa performs coliform analyses on samples from Santa Rosa Creek, including samples from stations at Melita and Willowside Road. They also analyze samples taken from Mark West Creek at Trenton-Healdsburg Road.

Table 22 presents the annual median most probable number of coliform organisms per 100 ml (MPN/100 ml), for each of the four stations on the Russian River, from 1951 to the present. The maximum and minimum values recorded during each year are also included.

The data in Table 22 indicate that coliform counts increased sharply from 1963 through 1965. The test method now in use detects

TABLE 22

ANNUAL COLIFORM COUNTS - RUSSIAN RIVER

Year	Coliform Count - MPN/100 ml - Maximum / Median / Minimum			
	Russian River at Guerneville	Russian River at Healdsburg	Russian River at Hopland	East Fork Russian River at Potter Valley
1951	62,000	700,000	700,000	6,200
	2,300	2,300	62,000	560
	62	23	23	62
1952	240,000	700,000	240,000	600
	370	1,400	4,200	62
	13	23	6	4.5
1953	240,000	700,000	700,000	700,000
	1,460	230	2,300	90
	6	13	62	4.5
1954	240,000	230,000	700,000	13,000
	620	1,700	6,200	230
	23	23	230	4.5
1955	700,000	62,000	130,000	23,000
	1,700	1,300	1,800	230
	23	13	4.5	4.5
1956	62,000	62,000	240,000	700,000
	1,800	2,300	2,300	620
	23	6	62	12
1957	700,000	700,000	700,000	700,000
	2,300	6,200	6,200	620
	23	21	130	12
1958	700,000	700,000	700,000	6,200
	620	1,300	6,200	1,300
	4.5	62	230	60
1959	62,000	210,000	240,000	62,000
	620	2,300	4,100	620
	4.5	13	4.5	4.5
1960	700,000	240,000	700,000	6,200
	2,300	620	5,000	210
	62	6	23	23
1961	700,000	240,000	240,000	2,300
	1,300	620	5,000	210
	62	23	23	13
1962	700,000	240,000	240,000	62,000
	960	230	5,000	2,300
	130	6	23	23
1963	700,000	700,000	62,000	6,200
	59,100	34,900	10,900	1,250
	230	23	230	23
1964	700,000	700,000	240,000	23,000
	64,200	43,700	31,300	3,800
	62	62	230	62
1965	240,000	130,000	62,000	23,000
	24,900	13,900	11,800	3,250
	230	620	620	230

organisms of soil origin as well as those emanating from the intestines of warm blooded animals. Therefore, the increasing coliform counts could be a result of either increased runoff and erosion, or increased discharge of poorly disinfected sewage-bearing waste water. Presently, data are insufficient to permit a positive conclusion.

The median coliform counts determined by the City of Santa Rosa during the investigation are presented in Table 23. The maximum and minimum recorded values are also presented.

TABLE 23

ANNUAL COLIFORM COUNTS

October 1965 - September 1966

Station	Coliform Count - MPN/100 ml. Maximum	Median	Minimum
Santa Rosa Creek at Melita	2,400	592	6
Santa Rosa Creek at Willowside Road	240,000	99,400	6,200
Mark West Creek at Trenton-Healdsburg Road	240,000	54,178	620

The coliform counts at Melita indicate the bacteriological quality of water in Santa Rosa Creek upstream from all sewage-bearing waste water discharges. The coliform counts at Willowside Road indicate the effect of the discharged waste water, most of which comes from the City of Santa Rosa. The station on Mark West Creek at Trenton-Healdsburg Road is downstream from the confluence of the Laguna de Santa Rosa and Santa Rosa Creek. Most of the waste water discharges from the Santa Rosa Valley are upstream of this station. The coliform counts here indicate the bacteriological quality of water flowing into the lower Russian River.

The median coliform counts in the Russian River at Guerneville were significantly higher than those at Healdsburg. This is attributed to the discharge from Mark West Creek into the lower Russian River, between Healdsburg and Guerneville. However, the summer impoundments for recreation could have provided a warm stagnant environment for coliform organisms which would have stimulated their growth.

Effect of Impoundment on Water Quality

Limnology is the scientific study of physical, chemical, meteorological, and biological conditions in fresh water, such as that found in lakes and reservoirs.

Water in a reservoir is continuously in motion, due to wind action, inflow, outflow, and variations in density and viscosity caused by changes in temperature. These physical phenomena generally produce seasonal stratification of lakes and reservoirs. Seasonal stratification involves the annual establishment of three zones: the thermocline, epilimnion, and hypolimnion.

The thermocline zone is a layer of water in which the temperature decreases by 1°C or more for each meter of depth (0.548°F per foot). The thermocline zone is formed in spring when the sun and air warm the surface of the water. A vertical temperature gradient is formed, within which the resulting density gradient inhibits the continued mixing of the entire water mass of the lake by existing winds. Circulation becomes increasingly confined to the upper water. Gradually a situation arises where the surface-water temperature is much higher than that of the underlying water. At the same time, or shortly thereafter, a thermal stratification develops, with the warmer, less dense water at the surface and the colder, heavier water at the lower depths. The thermocline zone is a transition zone between layers of warm and cold water, and is marked by a phenomenal drop in temperature per unit of depth.

The warmer water layer above the thermocline zone is known as the epilimnion zone. This is the zone of summer circulation and is essentially of uniform temperature throughout. Significant changes in the air temperature are usually followed by changes in water temperature.

The colder water layer below the thermocline zone is known as the hypolimnion zone. This is a zone of nearly constant temperatures throughout the period of thermal stratification. The thermocline zone constitutes an effective barrier against influences or disturbances originating at the surface.

During late fall or early winter, as air temperatures drop, surface water temperatures in lakes and reservoirs also drop. The temperature difference between the epilimnion and hypolimnion zones decrease, until the thermocline zone disappears. This usually occurs during January or February, and reduces the density gradient of the water. Strong winds then cause the water to roll and finally "overturn".

Each reservoir differs in size, shape, topography, location, and general development of watershed. Therefore, factors influencing the behavior or water quality of one reservoir may not be applicable to another.

<u>Limnology of Lake Mendocino</u>

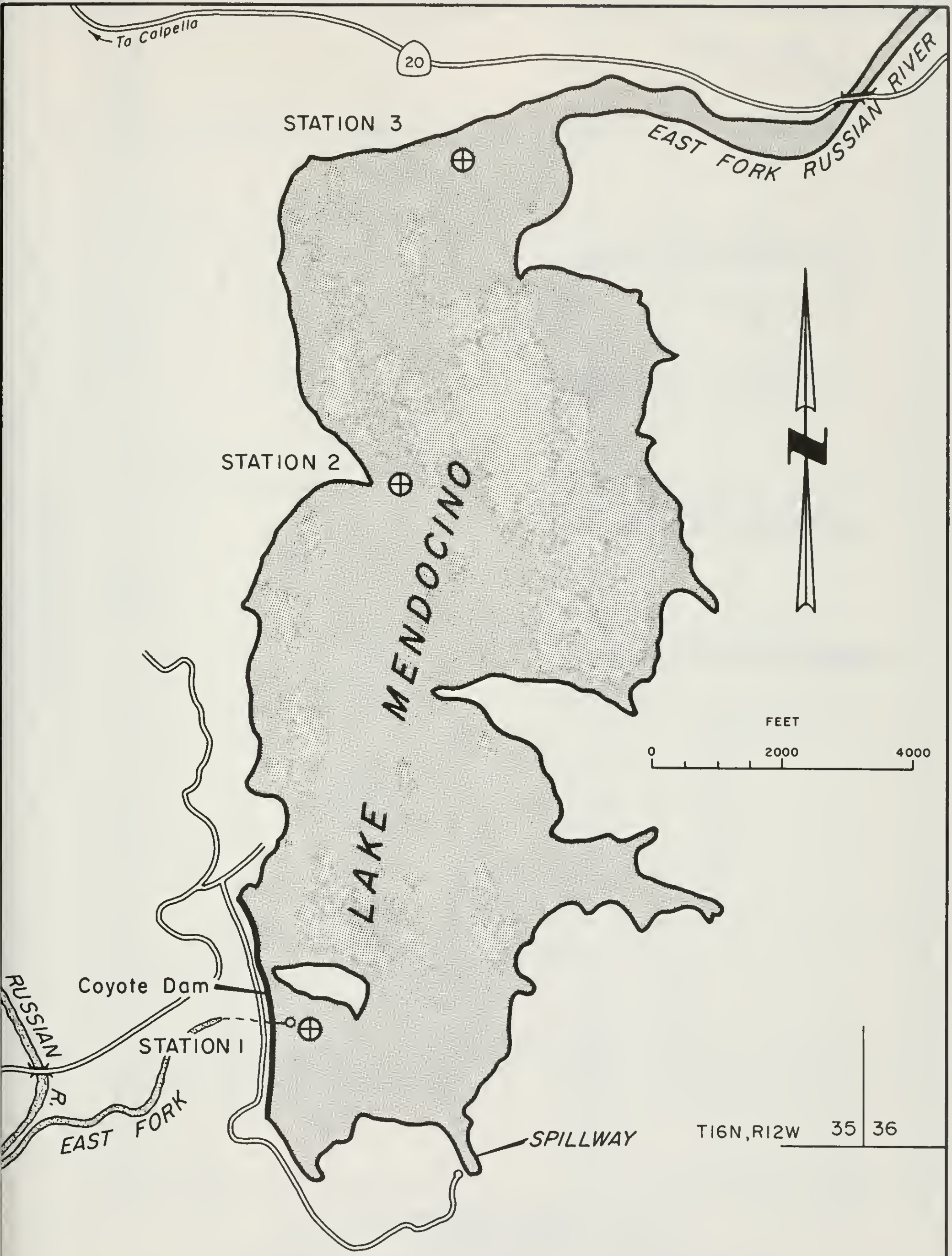
Lake Mendocino is in the Coyote Valley hydrologic subunit of the Russian River watershed. It is a man-made lake formed by impoundment of the waters of the East Fork of the Russian River behind Coyote Dam.

Lake Mendocino was sampled at three stations (Figure 7). Measurements of temperature, specific conductance, dissolved oxygen, and turbidity were taken at varying depths. Light penetration was determined by means of a hydrophotometer.

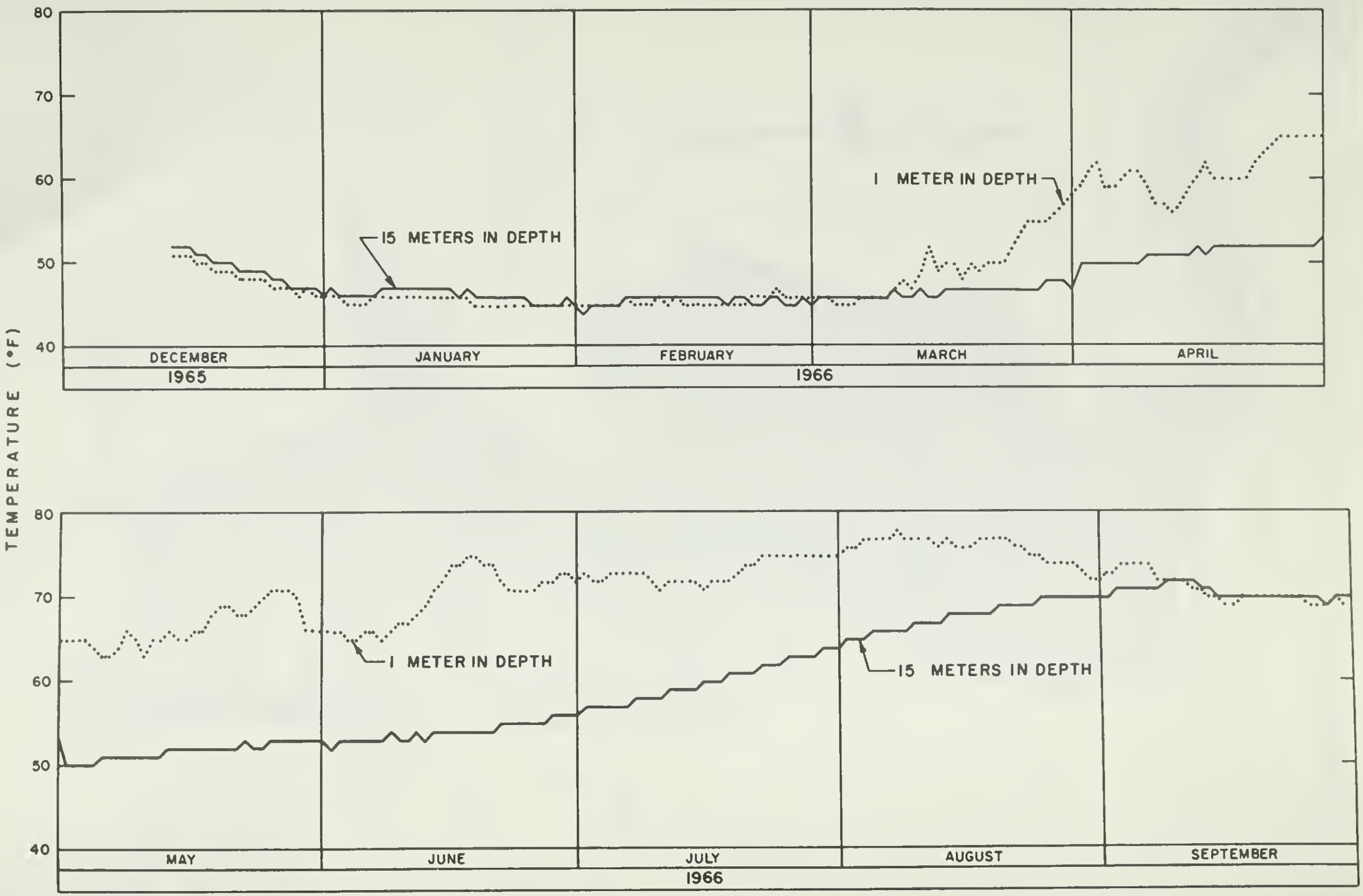
From December 1965 to November 1966, a multipoint temperature recorder was installed on the outlet tower at Coyote Dam. One probe was placed one meter below the water surface and one was placed 15 meters below the surface. The recorder permits observation of the development of thermal stratification which occurs from mid-March and through early September. Data obtained from the recorder are plotted on Figure 8.

Figures 9 and 10 show values of dissolved oxygen, temperature, turbidity, and specific conductance plotted against depth of the lake. Data were obtained from the sampling station at the base of the outlet tower at the dam. Figure 9 indicates conditions of the overturned lake, and Figure 10 indicates conditions when thermal stratification was fully developed.

Water temperatures in Lake Mendocino ranged from 6.5 to 27.1°C (43.7 to 80.8°F). The mid-summer thermocline zone was quite shallow, occurring at depths of 5 to 6 meters (16.4 to 19.6 feet). Thermocline zones in reservoirs and lakes in the San Francisco Bay Area often occur at depths greater than 50 feet. The shallow thermocline zone in Lake Mendocino is attributed to the relatively protected surface area. This prevents excessive wind action from mixing the top layer of water (epilimnion zone) with the upper thermocline zone.

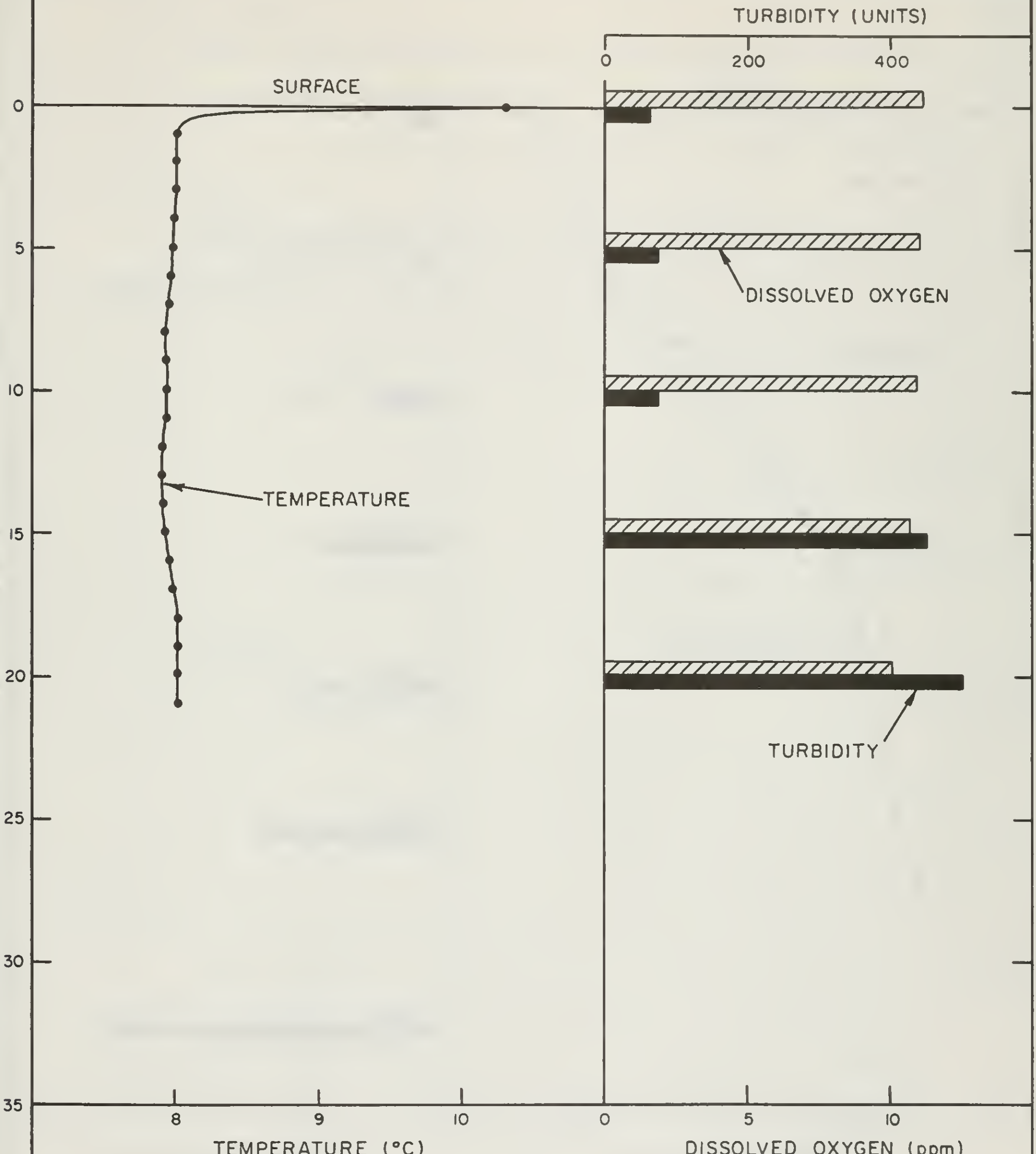


SAMPLING STATIONS ON LAKE MENDOCINO

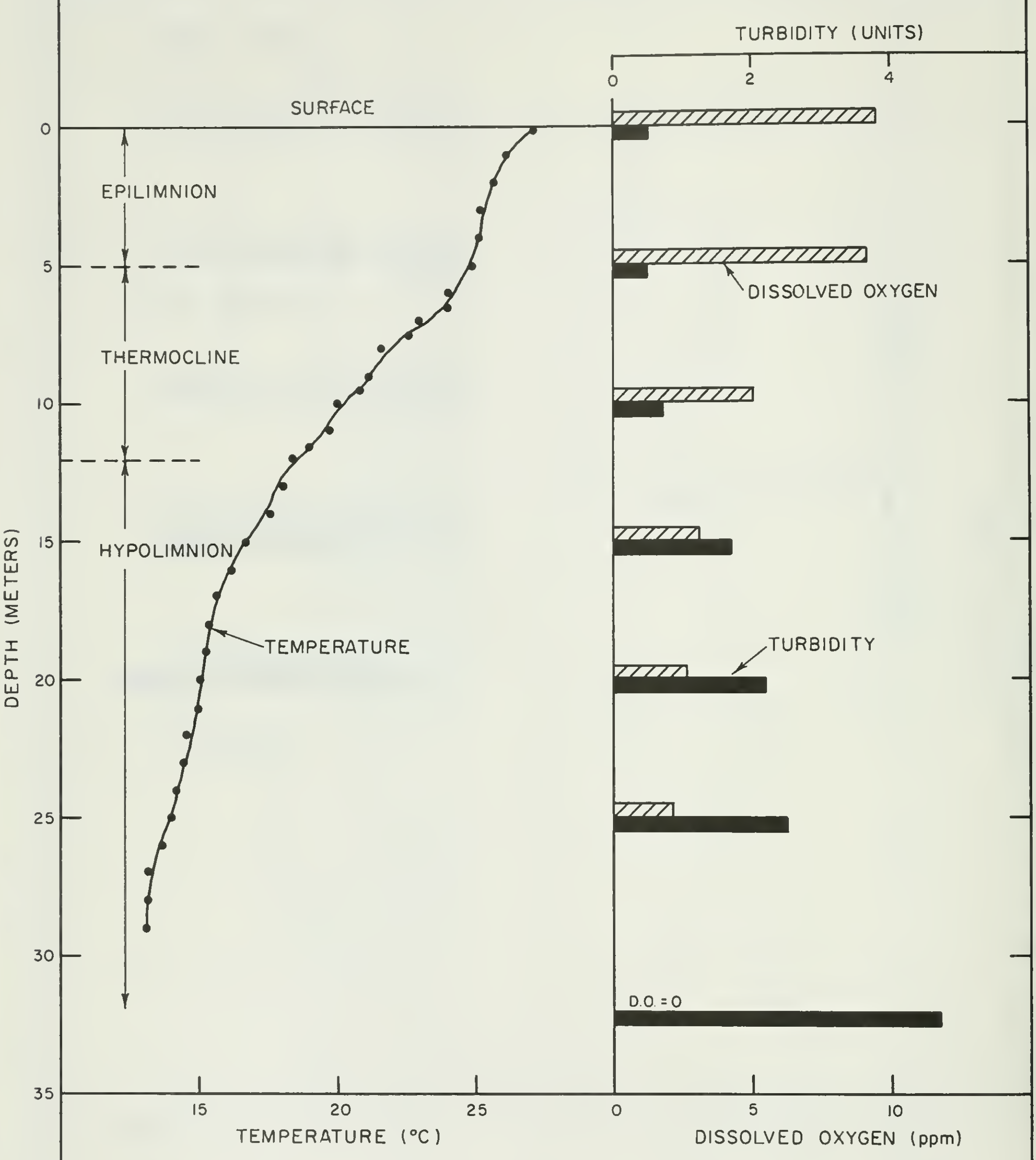


TEMPERATURES

LAKE MENDOCINO 1965-1966



LAKE MENDOCINO TEMPERATURE, TURBIDITY, AND DISSOLVED OXYGEN
JANUARY 12, 1966 – NO THERMAL STRATIFICATION



LAKE MENDOCINO TEMPERATURE,
TURBIDITY, AND DISSOLVED OXYGEN
AUGUST 5, 1966 - THERMAL STRATIFICATION

There are various water quality problems associated with the thermal stratification of Lake Mendocino. The outlet at Coyote Dam is at fixed level, and at times may draw relatively poor quality water from the hypolimnion zone.

The water in the hypolimnion zone was devoid of dissolved oxygen (anaerobic) at midsummer, due to decomposition of organic matter from either bottom sediments or from surface material that had settled. This water was completely reaerated within 200 yards of the outlet at the base of the dam.

The water in the hypolimnion zone is usually more turbid than water in the upper layers, due to settling of particulate matter. This particulate matter tends to settle relatively fast through the warmer, less dense, water near the surface and remains longer in the dense water of the hypolimnion zone. This results in a persistence of high turbidities in water flowing from the outlet of the dam.

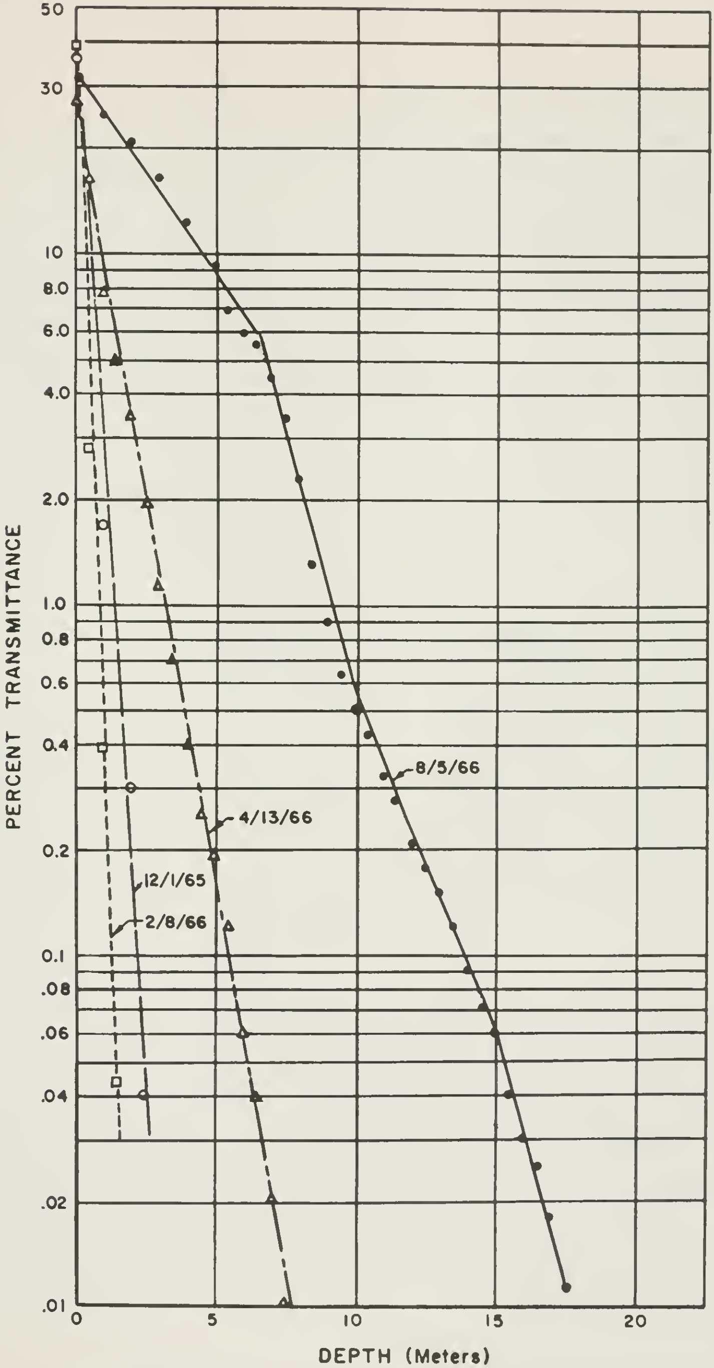
The fall overturn brings nutrients from the bottom of the lake to the surface where they stimulate phytoplankton growths. During September, shortly after an early overturn, phytoplankton was present in sufficient quantities to form windrows on the surface of the lake.

Light penetration is significant in determining the amount of biological activity in a lake. Light penetration through the water in Lake Mendocino was determined by means of a hydrophotometer. Basically, the hydrophotometer consists of two photoelectric cells. In operation, one cell is kept above water in the direct sunlight (deck cell) and another cell is lowered into the water to varying depths (sea cell). The ratio of the light intensity on the sea cell to the light intensity on the deck cell multiplied by 100 gives the percent of light that is transmitted to each depth. Therefore, the more transparent the water, the lower the depth at which the sea cell can receive light. Also, the lower the depth to which any percentage of light will be transmitted.

The data obtained from this test can be interpreted by two methods. One method is to compare the depths to which a given percentage of light can be transmitted, usually 1 or 0.1 percent. The lower this depth, the more transparent the water.

A second method of interpreting hydrophotometer data is to plot the logarithm of the percent transmittance against the depth. The slope of the resulting line, known as the coefficient of extinction, is a measure of the transparency of the water. The more transparent the water, the steeper, or larger the slope.

Hydrophotometer data obtained during four of the sampling periods are shown on Figure 11. The logarithm of the percent transmittance is plotted against the depth, in meters. The data indicates that the lake water was most transparent during the summer and least transparent about midwinter, due to high quantities of runoff. An interesting phenomenon can be noted in the August 1966 data. The curve can be drawn in three distinct sections. These sections occur at depths corresponding to the three zones of thermal stratification in the lake (see Figure 10). The first break in the curve occurs at the depth which corresponds to the upper limit of the thermocline zone. The colder and denser water in and below the thermocline zone retards the penetration of light to a greater degree than does the warmer, less dense water of the epilimnion zone. Also, particles causing turbidity settle rapidly through the epilimnion and remain in the thermocline and hypolimnion zones.



PERCENT LIGHT TRANSMITTANCE VERSUS DEPTH
LAKE MENDOCINO

Temporary Impoundments for Recreation

Temporary summer impoundments have been used to create a few of the swimming areas in the Russian River. The most notable are the recreation areas at Healdsburg, Guerneville, and Rio Nido.

The temporary impoundments affect water quality primarily by slowing the velocity of flow in the river, resulting in warmer temperatures and consequent growth of phytoplankton, bacteria, and aquatic weeds.

CHAPTER VIII. PRESENT GROUND WATER QUALITY

Ten ground water basins have been identified within the Russian River watershed. They are: (1) Potter Valley, (2) Ukiah Valley, (3) Sanel Valley, (4) McDowell Valley, (5) Cloverdale Valley, (6) Alexander Valley, (7) Knights Valley, (8) Santa Rosa Valley, (9) Rincon-Kenwood, and (10) Lower Russian River. Santa Rosa Valley is subdivided into the Healdsburg area and the Santa Rosa area. Knights Valley is subdivided into the North Basin and the South Basin. The Rincon-Kenwood basin is subdivided into the Rincon Valley and the North Kenwood Valley. These ten ground water basins are shown on Plate 6.

Physical and Chemical Characteristics

The physical and chemical characteristics of the various ground waters were determined from analyses of wells drawing water from the ground water basins. The usable storage capacity and the area of each of the ten ground water basins is shown in Table 24. Table 2, in Chapter V, summarized the chemical character of ground water in water-bearing materials found in ground water basins in the watershed.

Potter Valley Ground Water Basin

Potter Valley is a structural basin formed during the folding and faulting of the coast range. It is located in the east central portion of Mendocino County approximately 15 miles northeast of Ukiah. The valley is about 7 miles long, averages 1.75 miles in width, and contains an alluvial area of approximately 12.2 square miles.

TABLE 24

USABLE GROUND WATER STORAGE CAPACITY
RUSSIAN RIVER WATERSHED

Ground Water Basin	Area (Acres)	Usable Storage Capacity (acre-feet)
Potter Valley	4,500	9,000
Ukiah Valley	4,500	35,000
Sanel Valley	2,500	20,000
McDowell Valley	640	Unknown
Cloverdale Valley	3,000	15,000
Alexander Valley	7,500	60,000
Knights Valley (North and South Basins)	2,800	17,000
Lower Russian River	3,700	22,000
Rincon-Kenwood (Rincon Valley and North Kenwood Valley)	4,300	45,000
Santa Rosa Valley		
Santa Rosa Area	54,000	950,000
Healdsburg Area	11,500	67,000

The major sources of ground water include Recent alluvium, river channel, and terrace deposits. Yield to wells penetrating alluvium varies from 50 to 75 gpm, with specific capacities of from 1 to 5 gpm per foot of drawdown. Ground water recharge is by percolation of precipitation, excess irrigation water, losses from unlined irrigation canals, and stream percolation.

The only available mineral analyses of ground water in the basin were performed in 1953 and again in 1962. Analyses of ten wells and one spring, performed in May 1962, indicated that ground waters were bicarbonate in type with calcium and magnesium the predominant cations.

The water was generally of excellent quality. Total dissolved solids ranged from 144 ppm to 385 ppm. The concentration of all parameters except boron were below the limit for Class 1 (excellent to good) irrigation water. Wells No. 16N/11W-3D1 and No. 17N/12W-12A1 had water with boron concentrations of 1.3 ppm and 7.3 ppm.

Ukiah Valley Ground Water Basin

Ukiah Valley is located in southeastern Mendocino County. It is approximately 22 miles long, 5 miles wide, and 65 square miles in area. The basin has been carved in consolidated rock by a reach of the Russian River and is overlain with unconsolidated alluvium and older semiconsolidated sediments.

The major source of ground water is Recent alluvium. Producing wells yield up to 1,200 gpm with specific capacities varying from 0.5 to 7 gpm per foot of drawdown. Local specific capacities may exceed 100 gpm per foot of drawdown.

Major sources of recharge are percolation of streamflow, direct percolation of precipitation, irrigation return flow, and lateral migration of water stored in the consolidated bedrock. Ground water movement is from the margins of the valley toward the Russian River.

Mineral analyses of water from 11 wells, sampled in 1964 or 1965, indicated a bicarbonate-type water with calcium and magnesium the predominant cations. The mineral quality was excellent. Total dissolved solids in ten of the wells ranged from 137 ppm to 402 ppm. The concentrations of all parameters except boron were below the limit for Class 1 (excellent to good) irrigation water in ten of the wells.

Well No. 17N/12W-18A1, located at the edge of the valley, contained highly mineralized water with excessive quantities of total dissolved solids (1,280 ppm), sodium (86%), chloride (518 ppm), and boron (63 ppm). This was probably due to water migrating upward through faults from deep-seated geologic formations. Wells No. 14N/12W-5K1, and No. 15N/12W-16E1 located in the southern portion of the valley, produced water containing boron concentrations of 0.8 ppm, 2.1 ppm, and 0.7 ppm.

Sanel (Hopland) Valley Ground Water Basin

Sanel Valley, also called Hopland Valley, is an irregularly shaped alluvial area which lies along a reach of the Russian River about 12 miles south of Ukiah. It is about 8 miles long, has a maximum width of 6 miles, and an area of about 9 square miles.

The major source of ground water is unconsolidated alluvium which underlies the valley floor. This unconsolidated alluvium, which was deposited by the Russian River, varies in thickness from a few inches to 170 feet and overlies consolidated bedrock. Wells pumping from the alluvium yield from 500 to 1,200 gpm, with specific capacities ranging from 20 to more than 100 gpm per foot of drawdown.

Ground water is generally unconfined, with the exception of local pressure effects. Recharge is by percolation of streamflow, precipitation, and irrigation water. Ground water movement is from the margins of the valley toward and into the Russian River.

Mineral analysis of water from nine wells, sampled in 1964 and 1965, indicated bicarbonate water with the calcium and magnesium the predominant cations. The water was excellent in quality. Total dissolved solids ranged from 124 ppm to 215 ppm. All but three of the wells produced Class 1 (excellent to good) irrigation water with respect to all parameters. Wells No. 13N/11W-18D1 and No. 13N/11W-18D1 produced water containing 0.6 ppm boron. Well No. 13N/11W-18B1 produced water containing 2.4 ppm boron.

A 1955 analysis of Well No. 13N/11W-7J1 showed water of extremely high mineral content. The well was 1,000 feet deep and produced carbon dioxide gas for a dry ice company. It produced water containing 1,330 ppm magnesium, 1,020 ppm sodium, 4,130 ppm bicarbonate alkalinity, 1,220 ppm chlorides, and 690 ppm boron. The high mineralization of the water was probably due to deep-seated connate waters. The well was abandoned in 1956. Other abandoned carbon dioxide gas wells are located in the immediate area. Due to the corrosive effect of the water, the temperature, and the pressure, it is possible that the casings of some of the abandoned gas wells have failed and that usable ground waters are being degraded by mineralized waters from this source.

In view of the number of wells throughout the area which produce water with relatively high boron concentrations, new wells should be constructed in a manner that will eliminate degradation of usable ground water. Well construction and sealing standards are presented in Bulletin No. 62, Recommended Water Well Construction and Sealing Standards - Mendocino County.(11)

McDowell Valley Ground Water Basin

McDowell Valley occupies a depression that is structurally controlled by folding and faulting. It is located immediately east of Sanel Valley, is about 3 miles long and 1 to 5 miles wide, and includes an area of about 2 square miles.

Ground water occurs in uplifted differential Tertiary-Quaternary continental sediments and Recent alluvium. The major source is the alluvium. Recharge is by direct infiltration of rainfall and streamflow.

Wells pumping from the alluvium yield from 500 to 1,200 gpm, with specific capacities ranging from 20 to more than 100 gpm per foot of drawdown. Yields in the continental deposits are as low as 7 gpm with capacities of less than 1 gpm per foot of drawdown.

Water quality data available for McDowell Valley are limited. However, water quality is believed to be excellent with low total dissolved solids and no high concentrations of individual constituents. The water is probably bicarbonate in type with calcium and magnesium the predominant cations.

Cloverdale Valley Ground Water Basin

Cloverdale Valley is situated along the Russian River immediately south of the Mendocino County line and approximately 10 miles south of Sanel Valley. It is a narrow valley, approximately 6 miles long, and encompasses an area of about 8 square miles. The basin occupies a fault-complicated structural trough. At the southern end of the valley, a narrow section of alluvium forms a hydraulic link with the Alexander Valley ground water basin.

The major source of ground water is Recent alluvium. Wells yield up to 1,000 gpm with specific capacities of up to 250 gpm per foot of drawdown.

Major sources of recharge to ground water are infiltration and percolation of precipitation and streamflow. When the Russian River is at high stages it also provides recharge. Ground water movement is from recharge areas on the margins of the basin to the center of the valley and then southward.

Although the ground water is hard, the mineral quality is generally good. During dry seasons, some wells produce poor quality water from the underlying rock.

Alexander Valley Ground Water Basin

Alexander Valley is situated in faulted synclinal structures that have the same trend as the structures of the Cloverdale Valley. It is located along the Russian River immediately south of Cloverdale Valley and about 5 miles east of Healdsburg. It is a narrow valley, approximately 14 miles in length, and includes an area of about 33 square miles.

Major sources of ground water are the Tertiary-Quaternary Glen Ellen Formation and Recent alluvium. The Glen Ellen Formation yields substantial quantities of water (up to 400 gpm with specific capacities from 3 to 8 gpm per foot of drawdown) to deep wells and acts as a forebay for the alluvium in the valley. The alluvium yields 200 to 500 gpm with specific capacities of 10 to 100 gpm per foot of drawdown in shallow wells near the Russian River. Further from the river, yields in alluvium are less than 200 gpm with specific capacities of 2 to 5 gpm per foot of drawdown.

Ground water recharge is from precipitation and percolation from streams tributary to the Russian River. The Russian River provides some recharge during high flows. Ground water moves from the margins of the valley towards the Russian River where it appears as effluent at normal and low stages.

Mineral anlysis of samples taken in 1964 and 1965 from five wells indicated that the ground water was bicarbonate in type with magnesium, calcium, and sodium the predominant cations. The water was generally of good quality. Total dissolved solids ranged from 130 ppm to 425 ppm. Four of the wells produced Class 1 (excellent to good) irrigation water with respect to all parameters.

Well No. 9N/8W-7Q1, located in the southern end of the valley, produced water containing 94 percent sodium, rendering it Class 3 (injurious to unsatisfactory) irrigation water. Water from this well also contained 425 ppm total dissolved solids which was close to the upper limit for Class 1 irrigation water (500 ppm).

Knights Valley Ground Water Basin

Knights Valley is situated in faulted synclinal structures similar to those of Alexander Valley. It is located about 3 miles southeast of Alexander Valley and has a total area of about 4.5 square miles. The valley includes two alluviated areas known as the North Basin and the South Basin, which are separated by a narrow strip of nonwater-bearing consolidated rock. Although they may be considered as two separate ground water basins, they are discussed as one in this report.

The major source of ground water in Knights Valley is Recent alluvium. Yields are similar to those of Alexander Valley. Ground water is probably unconfined, and the depth to ground water is unknown. Movement of ground water is probably toward streams in the central portion of the alluviated areas, and then downstream.

There are only limited data regarding ground water quality. However, ground water is believed to be calcium-magnesium bicarbonate type containing low total dissolved solids.

Santa Rosa Valley, Rincon-Kenwood, and Lower Russian River Ground Water Basins

There are three ground water basins in the approximately 210 square-mile area of water-bearing sediments in valleys between the Pacific Ocean and Alexander Valley. The area extends from about 11 miles north of Healdsburg southward along Dry Creek to a topographic divide about 1 mile south of Cotati. The eastern boundary is the Napa-Sonoma County line, south of Knights Valley. The Pacific Ocean forms the western boundary at the end of the narrow canyon of the lower Russian River Valley. The three separate ground water basins in this area are similar and are therefore grouped together for the purpose of this report.

The ground water basins occur in structurally controlled valleys. Most of these valleys follow faulted synclines, or downfolds, with a northwest trend. The lower Russian River, however, cuts across the trend of geologic structures west of Rio Dell on its way to the Pacific Ocean.

Major sources of ground water are the Tertiary-Quaternary Merced and Glen Ellen Formations, although they are only moderately permeable. Ground water in these deposits is mostly confined. Deep wells yield about 550 gpm with specific capacities of 5 to 10 gpm per foot of drawdown.

Recent alluvium along the Russian River is a productive water-bearing deposit. Ground water is mostly unconfined. Wells yield over 500 gpm with specific capacities of 75 to 200 gpm per foot of drawdown.

Pleistocene continental terrace deposits contain some water under confined conditions. They are only moderately permeable due to partial consolidation. Yields to wells are 10 to 200 gpm with specific capacities of about 7 gpm per foot of drawdown.

Ground water recharge in the three basins is by infiltration of rainfall and streamflow in areas underlain by permeable deposits. Subsurface movement of water from the Merced and Glen Ellen Formations and from the continental terrace deposits provides recharge for the overlying and adjacent alluvium.

Most available water quality data relate to wells in the Santa Rosa Valley. Mineral analyses taken in 1964 and 1965 from 14 wells indicated that the ground water was bicarbonate in type with sodium the predominant cation. The water from 13 of the wells was generally excellent in quality and Class 1 (excellent to good) irrigation water with respect to all parameters. Total dissolved solids ranged from 151 to 441 ppm. Well No. 7N/8W-13P1 produced water containing 560 ppm total dissolved solids, rendering it Class 2 (good to injurious) irrigation water.

In the Lower Russian River ground water basin, below Duncans Mills, wells near the river produced water with high concentrations of sodium chloride. They are apparently recharged by brackish water from the tidal reach of the river.

Water Quality Hazard Areas

Analysis of ground water quality data indicates that there are a number of water quality hazards in the Russian River watershed. The hazards are mainly due to concentrations of boron and sodium, and sea water intrusion.

Boron Hazard

Boron concentrations in excess of 0.5 ppm have been reported in samples from 42 wells. The areal distribution of these wells is presented on Plate 7, while the range in boron concentration at these wells is presented in Table 25.

Boron concentrations in ground water can be attributed to several sources. For example, connate water in older marine sediments typically contains appreciable quantities of boron. This is the most probable source of the boron reported in Wells No. 14N/12W-26K1 and No. 15N/12W-14C1, and other wells tapping the Jura-Cretaceous and Cretaceous sediments. Degradation from connate marine water is also suggested by the analyses from Well No. 7N/9W-14K1 and others which tap the marine portion of the Merced Formation.

Well No. 10N/10W-27D2 was drilled into Jura-Cretaceous gabbro. The presence of 13.36 ppm boron is fairly typical of ground water degraded by plutonic or magmatic water contained in the gabbroic mass.

Certain wells tapping materials near or along a fault trace yield water containing objectionable concentrations of boron. This is illustrated by Well No. 6N/7W-17E1 which taps sediments of the Sonoma volcanics. The reported concentration of 2.0 ppm can be attributed to boron-rich juvenile

TABLE 25

BORON CONCENTRATION IN GROUND WATER IN EXCESS OF 0.5 ppm

Well	Depth (Feet)	Water-Bearing Unit*	Boron Concentration (ppm)
6N/7W-16D1	38	Qal/Tsv	0.64
-17E1	650	Tsv	0.4 - 2.0
7N/8W-18Q1	811	Tm	0.9 - 0.84
-24A4	1,000	Tsv	0.54
7N/9W-14K1	588	Tm	1.28
-36M1	88	TQge	0.0 - 0.55
7N/11W-15	--	Qal	0.50
-20G1	--	Qal	0.52
8N/9W-10R1	400	TQge	0.63
-27K1	333	Tm	1.04
-36K1	1,325	TQge/Tm	2.33
-36P1	1,048	TQge/Tm	0.62- 4.0
9N/9W-1P1	90	Qal	0.0 - 1.3
-4E1	117	TQge/Kc	14.0 -40.0
-4E2	32	Qal	4.4
-9L1	90	Tsv	1.0
10N/9W-18R1	14	Qal	0.4 - 1.8
-32R1	245	Kc	0.0 - 0.62
10N/10W-27D2	126	JKi	13.36
11N/8W-19	Spg	Tsv	3.6
11N/10W-33A1	12	Qal	0.6 - 4.2
-33G1	18	Qt	0.07- 2.9
-34D1	5	Qal	2.0
13N/11W-7J1	1,000+	JK	404.0
-18B1	35	Qal	0.84- 2.4
-18D1	60	Qal	0.29- 1.5
-18J1	--	Qal	0.6
-18Q1	52	Qal	3.4
-19C1	--	Qal	1.6
-30H1	--	Qal	0.2 - 0.52
14N/12W-5K1	92	Qal/JK	0.6 - 1.14
-26F1	46	Qal/JK	1.8 -43.6
-26K1	300	JK	11.0 - 3.0
15N/12W-8D1	165	Qal/TQc	0.0 - 0.78
-14C1	---	JK	8.4
-21H1	---	Qal	0.5 - 1.1
-22D1	22	TQc	8.3
16N/11W-5G1	38	Qal/JK	0.58- 1.3
17N/11W-18A2	60	Qal	0.61
-33D1	671	Qal/JK	1.0
17N/12W-12A1	42	Qal/JK	7.3
-18A1	57	Qt/JK	45.0 -84.0

*Qal: Alluvium; Qt: Terraces; TQc: Continental sediments; TQge: Glen Ellen Formation; Tm: Merced Formation; Kc: Cretaceous conglomerate; JK: Jura-Cretaceous marine sediments; JKi: Jura-Cretaceous intrusive rocks.

waters rising along a fault zone and commingling with the natural ground water. Many of the other wells containing relatively large concentrations of boron can be related to a buried fault zone (Plate 2).

A few wells, such as Well No. 8N/9W-10R1, tap the Glen Ellen Formation and do not appear to be located along a fault trace. The presence of boron in these wells may be due to percolation of ground water through old soil horizons containing large quantities of boron salts.

Hazardous concentration of boron in shallow wells, such as in Well No. 10N/9W-18R1 is most probably due to direct percolation of surface water containing large concentrations of boron. Table 26 indicates boron concentrations which range up to 13.0 ppm in surface water available for recharge. As may be noted from the table, boron concentrations are highest during periods of low flows and are lowest during winter runoff times. Streams draining areas of thermal springs contribute the greatest quantity of boron. This is demonstrated by the water in Sulphur Creek, which is derived from Vichy Springs, and contains 13.0 ppm boron.

Table 27 presents mineral analyses of water from twenty springs in this area. Many of these springs contribute boron-rich water for recharge to the ground water basin.

Sodium Hazard

Nine wells were sampled which contained water having a moderate to extreme sodium hazard. These wells, listed in Table 28, have sodium percentages ranging from 62 to 98.

TABLE 26

BORON CONCENTRATIONS IN SURFACE WATER AVAILABLE FOR RECHARGE

Stream	Station Location	Minimum Boron Discharge (cfs)	Minimum Boron Boron (ppm)	Maximum Boron Discharge (cfs)	Maximum Boron Boron (ppm)
Russian River	8N/10W-32C	20,800	0.18	246	0.83
	9N/9W-22H	14,500	0.17	228	0.93
	14N/12W-36K	1,330	0.13	253	0.40
East Fork Russian River	16N/12W-13K	1,040	0.11	259	0.33

Stream	Station Location	Discharge (cfs)	Boron (ppm)
Unnamed creek	9N/9W-20H	10	0.58
Warm Springs Creek	10N/10W-18	--	0.1 - 2.8
Dry Creek	10N/11W-11	--	0.53
Big Sulphur Creek	11N/10W-5	8	0.51
Morrison Creek	14N/12W-11R	0.5	0.88
Sulphur Creek	15N/12W-16G	0.4	13.0
Middle Creek	15N/12W-26G	0.2	1.6
Bush Creek	17N/12W-12D	0.4	0.67

Excessive amounts of sodium may be attributed to any one of three sources or a combination thereof. Most excessive sodium is due to cation exchange in ground water percolating through sediments containing the clay mineral montmorillonite. The cations in solution in ground water and the adsorbed ions held by the montmorillonite particles react according to the formula $2NaX + Ca^{++} = CaX_2 + 2Na^+$ where X

TABLE 27

MINERAL ANALYSES OF SPRING WATERS 1/

Name and Location	Total Flow (gpm)	Spring	Temp. (°F)	Ca	Mg	Na	K	CO_3	CO_2	Cl	SO_4	SiO_2	Al	Fe	BO_2	H_2S
				Mineral Constituents in ppm												
Duncan Springs 13N/12W-25	2-1/2	Carbonate Spring	57	496	220	363	---	1610	153	178	0	Tr 2/	---	Tr	---	---
		Magnesia Spring	--	67	268	11	---	746	311	18	22	119	---	0	---	---
The Geysers 11N/9W-13	25	Iron Spring	72	20	9.5	Tr	Tr	---	Tr	---	88	25	2.1	1.2	---	28.1
		Bath Spring	137	42	69	22	Tr	---	---	---	88	137	5.1	1.3	330	183
		Indian Spring	108	50	76	29	1.6	---	279	---	40	81	1.6	0.6	---	*
		Eye Spring	138	45	40	18	---	---	---	---	55	614	0.5	0.7	---	*
		Devils Teakettle	212	22	135	322	---	---	---	---	4230	220	84	---	---	*
		Witch's Cauldron	212	35	33	130	2.1	---	---	---	795	75	7.9	---	---	*
		Alum Spring	98	12	82	40	Tr	---	5.1	Tr	1376	161	156	39	20	41.9
		Hot Alum Spring	139	---	125	19	Tr	---	---	0	1665	281	170	45	Tr	62
		Hot Acid Spring	136	22	316	32	5.5	---	---	---	4540	361	156	80	---	*
		Lemonade Spring	103	---	141	177	37	---	---	20	2570	282	87	59	---	*
Lytton Springs	3/4	Main Spring	62	85	63	1104	35	973	6430	822	153	138	62	18	32	---
		Minor Spring	---	31	28	196	---	293	*	103	39	31	---	31	---	---
McDowell Springs 13N/11W-25	1	Main Spring	---	40	31	7.7	2.9	206	336	5.5	5.3	69	2.8	53	Tr	0
Skaggs Springs 10N/11W-24	15	Main Spring	129	26	61	879	9.8	1157	1057	60	26	151	Tr	5	176	---
Taylor Springs 7N/8W-36	1	Main Spring	60	7	35	93	6.3	35	35	59	220	20	8.4	Tr	Tr	43
Vichy Springs 15N/12W-15	30	Main Spring	90	122	112	1654	Tr	2375	2128	285	Tr	117	Tr	Tr	Tr	---
		Ardeche Spring	90	133	48	1141	20	1612	---	204	---	54	---	9.1	66	---
		Crystal Spring	59	149	58	1248	19	1716	---	250	---	32	---	7.9	68	---

* Excess

1/ From U. S. G. S. Water Supply Paper 338

2/ Trace

TABLE 28

WELLS HAVING MODERATE TO EXTREME SODIUM HAZARD

	Depth (feet)	Geologic Formation *	Ca (ppm)	Mg (ppm)	Na (ppm)	Na (%)	EC (micro-mhos)	SAR	Sodium Hazard
6N/7W-17E1	650	Tsv	1.4	0.0	98	98	420	16.5	High
7N/9W-13R1	375	TQge	15	5	120	78	600	6.8	Moderate
7N/11W-16	---	Qal	85	206	1,620	75	9,400	21.6	Extreme
-20G1	---	Qal	39	85	360	62	2,740	7.4	Moderate
8N/9W-10R1	400	TQge	4.8	4.1	31	64	214	14.6	Moderate
-36K1	1,325	TQge/Tm	15	5	150	86	700	8.6	Moderate
-36P1	1,048	TQge/Tm	15	6.9	211	85	952	11.3	Moderate
9N/8W-7Q1	490	TQge	4	1	138	94	611	11.0	Moderate
17N/12W-18A1	57	Qt/JK	38	6.1	364	87	2,032	14.4	High

* Qal: Alluvium; Qt: Terraces; TQge: Glen Ellen Formation; Tm: Merced Formation; Kc: Cretaceous conglomerate; JK: Jura-Cretaceous marine sediments.

represents a unit of exchange capacity in the solid phase material. Thus, calcium ions in solution replace the adsorbed sodium on the exchange material, and this results in ground water containing excessive quantities of sodium and little, if any, calcium. The analysis of water from Well No. 6N/7W-17E1 is typical of ground water that has undergone cation exchange.

Sodium hazard also may be incurred through sea water intrusion as indicated by the analysis of water from Well No. 7N/11W-16. Intrusion is indicated by the combination of excessive sodium ion and extremely high electrical conductivity.

Sea Water Intrusion

Near Jenner, at the mouth of the Russian River, ground water is degraded by sea water intrusion. Chloride concentration in ground water in the area west of Duncans Mills ranges up to 400 times greater than in normal ground water. Analyses of water taken from Well No. 7N/11W-16 and from Well No. 7N/11W-20G1, shown in Table 28, are indicative of such intrusion. Encroachment of sea water into the ground water basin increases during years in which natural recharge is deficient and ground water outflow is correspondingly reduced.

Effects of Wastes Discharged to Land

Wastes discharged to land in the Russian River watershed are generally from any one of three sources or a combination thereof. Wastes may be from domestic waste water treatment plants, from industries, particularly food processing plants, or from solid waste disposal operations. The wastes may be classified as either solid or liquid.

Presently available data concerning the effects of wastes on ground waters within the watershed are limited. A detailed ground water study of the watershed would be necessary to accurately assess the effects of wastes discharged to land.

Domestic Waste Water Treatment Plants

Domestic waste water treatment plants discharge treated effluent to land as a means of disposal and for reclamation by irrigation. When effluent is discharged to oxidation ponds for final biological treatment it can seep into the ground and possibly degrade usable ground water.

The cities of Healdsburg, Ukiah and Sebastopol dispose of waste water effluent on land during the summer months. Mendocino State Hospital reclaims 0.6 mgd and the City of Sebastopol reclaims 0.5 mgd of waste water effluent by irrigation. The cities of Santa Rosa, Cloverdale, Sebastopol and Ukiah have oxidation ponds which allow effluent to seep into the ground to possibly degrade the ground water.

Effluent from the waste water treatment plants in the watershed is either Class 1 (excellent to good) irrigation water or Class 2 (good to injurious) due to concentrations of only one or two parameters. Water of this type when discharged at existing volumes probably causes only minor ground water problems of a localized nature. However, if the treatment plants were to begin reclamation of 100 percent of effluent in order to economically meet stringent discharge requirements, degradation of usable ground water could become a serious problem.

Industries

Wineries constitute the largest number of industrial dischargers in the Russian River watershed. Winery waste water is commonly retained in shallow ponds or discharged to creek beds. The creek beds are usually dry during the grape-crushing season. The liquid portion of the waste is dissipated by evaporation and by percolation into the soil.

In June 1952, a report entitled Effect of Winery Wastes Disposal on Ground Water, Sonoma County was prepared for the North Coastal Regional Water Quality (then Pollution) Control Board by the Department (then the Division) of Water Resources. The report indicated that the major hazard to receiving waters (ground or surface) from winery wastes was from distillery wastes known as "still slop". The report found that localized pollution of ground water took place immediately adjacent to waste ponds containing still slop and the pollution was due to high total dissolved solids in this form of winery waste. The pollution was not sufficient to render the water unfit for most irrigation uses.

At the present time, disposal of winery wastes to land probably results in only minor local ground water problems.

The Masonite Corporation discharges to land 1.7 mgd of industrial waste from wood-washing operations. The effect of this waste water on the ground water is now being monitored. In most respects, the waste water is Class 1 irrigation water so no significant mineral degradation of ground water should occur. Present monitoring is for nutrients.

Solid Waste Disposal Operation

There are seven large solid waste disposal operations or dump sites in the Russian River watershed. Most of these are sanitary landfills. Three of the disposal operations are currently operating under criteria established by the North Coastal Regional Water Quality Control Board.

Rain water or water from springs which has percolated through dump sites can pollute usable ground water. Dump sites that extend below the ground water table can also pollute usable ground water. Various constituents are leached from material in the landfill by the water. The leachate contains high values of some parameters, such as total dissolved solids, alkalinity, iron, hardness, and biochemical oxygen demand. Some of these parameters can cause pollution of usable ground water.

Presently, there are no data available to assist in evaluation of pollution of usable ground water caused by dump sites in the watershed. This information could be determined by requiring a monitoring well for each dump site located in an area where there is usable ground water.

CHAPTER IX. EXISTING WASTE WATER DISCHARGES

Waste water in the Russian River watershed is either discharged into the Russian River (directly or indirectly) or disposed of on land by percolation and evaporation. Waste water discharges are classified by origin as either domestic or industrial. In this chapter, the major discharges (0.5 mgd or greater) are discussed in some detail.

Domestic Waste Water Discharges

There are six major domestic waste water dischargers in the Russian River watershed: the cities of Healdsburg, Cloverdale, Santa Rosa, Sebastopol and Ukiah; and the Mendocino State Hospital. Because the Russian River is used by many people for swimming and other forms of water recreation, stringent requirements are imposed by the Regional Water Quality Control Board on all waste discharges to the river and its tributaries during the recreation season. The cities of Cloverdale and Ukiah discharge treated waste water to the Russian River during the high flow periods but retain the effluent on land during the recreation season (usually from Memorial Day to Labor Day). The City of Healdsburg discharges treated waste water to Dry Creek during the high flow periods but retains the effluent in ponds in the creek bed during the recreation season. The City of Santa Rosa discharges treated waste water to Santa Rosa Creek. The Mendocino State Hospital retains all treated waste water on land. Virtually, all of the effluent from the City of Sebastopol is reclaimed during the summer. During the winter, it is discharged into the Laguna de Santa Rosa.

The City of Healdsburg

The City of Healdsburg has a secondary sewage treatment plant capable of treating 0.3 mgd. Presently, this plant serves a population of 5,000 and treats about 0.5 mgd of domestic and industrial waste water.

The treatment plant, constructed in 1939, is located 1 mile west of Healdsburg near Dry Creek. Secondary treatment is provided by primary and secondary clarification and two-stage trickling filters. During the summer, the plant effluent is discharged to the gravel bed of Dry Creek adjacent to the plant for disposal by percolation and evaporation.

In April 1966, mineral analyses of the effluent indicated a very hard (222 ppm) water that was Class 2 (good to injurious) irrigation water, due to the concentration of boron (0.6 ppm).

The Mendocino State Hospital

Mendocino State Hospital has a secondary sewage treatment plant which uses primary clarification, trickling filtration, secondary clarification and sludge digestion treatment methods. The plant, constructed in 1939, is designed for a flow of 1.0 mgd. Presently, this plant serves a population of 3,100 and treats 0.6 mgd of combined waste water (domestic, industrial, and storm).

The plant effluent is presently discharged to a percolation ditch. During the summer months, 75 percent of the effluent is used for irrigation of crops.

In October 1965, mineral analyses of the effluent indicated a moderately hard (167 ppm) water which was Class 1 (excellent to good) irrigation water with respect to all constituents.

The City of Santa Rosa

The City of Santa Rosa has a secondary sewage treatment plant with a design capacity of 5 mgd. Presently, this plant serves a population of 38,000 and treats about 5.6 mgd of domestic and industrial waste water.

The treatment plant, constructed in April 1952, is located about 2 miles west of the City of Santa Rosa near Santa Rosa Creek. Secondary treatment is provided by preaeration, primary sedimentation, high-rate trickling filters, secondary sedimentation, and oxidation ponds. The plant effluent is discharged to Santa Rosa Creek except for a very small amount which is used for irrigation.

In April 1966, mineral analyses of the effluent indicated that it was a moderately hard water (200 ppm) and Class 1 (excellent to good) irrigation water. However, analyses performed in October 1965 indicated that it was Class 2 (good to injurious) due to the concentrations of boron (0.7 ppm). In October 1965, an electrical conductivity recorder was installed to record the electrical conductivity of the plant effluent. Results from October 1965 to April 1966 are presented in Appendix D.

The City of Ukiah

The City of Ukiah's sewage treatment plant is capable of treating 2.5 mgd. Presently, this plant serves a population of 11,000 and treats about 1.6 mgd of domestic waste water.

The secondary treatment plant, constructed in 1958, is located about one mile southeast of town. The waste water influent is treated by sedimentation, biofiltration, aeration, and oxidation ponds. The effluent is retained on land during the Russian River recreation season, at which time a small portion (4,000,000 gallons per year) of the effluent is used for irrigation. During the remainder of the year, effluent from the oxidation ponds is discharged to the Russian River.

In April 1966, mineral analyses of the effluent indicated that it was a moderately hard water (121 ppm) and Class 1 (excellent to good) irrigation water with regard to all constituents.

The City of Cloverdale

The City of Cloverdale's sewage treatment plant is designed to treat the domestic waste water for a population of 8,000 and a flow of 0.8 mgd. The present population of the city is 2,880 and the present waste water flow is 0.4 mgd.

Secondary treatment of the waste water influent is by means of clarification, trickling filtration, and oxidation ponds. The effluent is discharged to the Russian River during the winter and retained on land during the summer recreation season.

In April 1966, mineral analyses of the effluent indicated that it was a moderately hard (113 ppm) water and Class 1 (excellent to good) irrigation water with regard to all constituents. However, analyses performed in October 1965 indicated that it was Class 2 (good to injurious) due to the concentration of boron (0.7 ppm).

The City of Sebastopol

The sewage treatment plant for the City of Sebastopol is capable of treating 1.5 mgd of domestic waste water. Presently, this plant serves a population of 3,500 and treats about 0.5 mgd of domestic waste water.

The waste water receives secondary treatment in the plant, including storage in oxidation ponds. The effluent from the ponds is discharged to the Laguna de Santa Rosa during the winter. About 78,000,000 gallons per year of effluent is used for summer irrigation of pasture.

In April 1966, mineral analyses of the effluent indicated that it was a moderately hard (140 ppm) water and Class 2 (good to injurious) irrigation water, due to the concentration of boron (0.6 ppm). Analyses performed in November 1965 indicated that it was Class 2 irrigation water, due to the concentration of boron (0.6 ppm) and the percent sodium (64%).

Minor Domestic Waste Water Discharges

In addition to the major (0.5 mgd or greater) domestic waste water discharges, there are numerous smaller discharges in the Russian River watershed. These discharges range in volume from the discharge from a single summer cabin to a discharge from the smaller communities. Some of the minor domestic waste water discharges and all of the major domestic waste water discharges are listed in Table 29.

Industrial Waste Water Discharges

There are numerous industrial waste water discharges in the Russian River watershed. These are generally from wineries, food processing plants, and wood processing plants. The largest industrial waste water discharge is by the Masonite Corporation in Ukiah. Table 30 lists most of the industrial waste water discharges in the Russian River watershed.

The Masonite Corporation

The discharge by the Masonite Corporation consists of about 1.7 mgd industrial waste water (wood washings) and 0.02 mgd domestic waste water. The domestic waste water is settled and pasteurized before mixing with the industrial waste water. Discharge is to land for percolation and irrigation. Runoff flows into the Russian River. A special type of grass on the disposal site removes some dissolved solids.

Mineral analyses of the waste water from one source, performed in June 1961, indicated a soft (87 ppm) water that was Class 1 (excellent to good) irrigation water. However, analyses of the water from another

TABLE 29

SOME DOMESTIC WASTE WATER DISCHARGES WITHIN
THE RUSSIAN RIVER WATERSHED

DISCHARGER	TREATMENT	DISCHARGE TO	FLOW (mgd)	POPULATION SERVED
Mendocino County				
Calpella				
Calpella County Water District	Imhoff Tank	Russian River	Unknown	200
Ukiah				
City of Ukiah	Secondary	Russian River	1.6	11,000
Mendocino State Hospital	Secondary	Land	0.5	3,100
Sonoma County				
Cloverdale				
Big Geysers Resort	Septic Tanks	Land	Unknown	Unknown
City of Cloverdale	Secondary	Russian River	0.4	2,880
Cotati				
City of Cotati	Primary	Ponds	0.1	1,073
Forestville				
Forestville County Sanitation District	Secondary	Green Valley Creek	0.09	910
Guerneville				
DeBois Resort	Septic Tank	Land	0.0003	42
Healdsburg				
City of Healdsburg	Secondary	Dry Creek	0.5	5,000
Rio Lindo Academy	Unknown	Ponds	0.005	500
Westune Madams Subdivision	Unknown	Ponds	0.04	600
Maacama Creek Camp Fire Girls Camp	Septic Tanks	Land	0.0015	150
Occidental				
Occidental County Sanitation District	Primary	Dutch Bill Creek	0.02	Unknown
Rohnert Park				
City of Rohnert Park	Unknown	Ponds	Unknown	Unknown
Santa Rosa				
City of Santa Rosa	Secondary	Santa Rosa Creek	5.6	38,000
Las Guilicos State School for Girls	Primary	Ponds	0.005	300
Larkfield Subdivision	Septic Tanks	Land	0.2	2,000
Marine Cooks and Stewards School	Unknown	Porter Creek	0.004	200
Minimum Security Jail	Septic Tanks	Land	0.005	105
Oakmont Subdivision	Secondary	Santa Rosa Creek	0.004	540
Optical Coating	Septic Tanks	Land	0.0024	50
Ursuline High School	Unknown	Land	0.013	520
Sebastopol				
City of Sebastopol	Secondary	Laguna De Santa Rosa and Land	0.5	3,500
Windsor				
Fluor Products Company	Septic Tanks	Land	Unknown	180
Windsor County Water District	Secondary	Windsor Creek	0.026	1,270

TABLE 30

SOME INDUSTRIAL WASTE WATER DISCHARGES WITHIN THE RUSSIAN RIVER WATERSHED

Discharger	Treatment	Industry	Discharge To	Flow (mgd)
Mendocino County				
Calpella				
Arthur B. Siri, Inc.	Pond	Gravel Plant	Russian River	Unknown
Thrasher Lumber Company	Unknown	Lumber	Russian River	Unknown
Ukiah				
Ford Gravel Company	Pond	Gravel Plant	Russian River	Unknown
Garrett Winery	Ponds	Winery	Russian River	Unknown
Masonite Corporation	Unknown	Building Material	Land	1.7
Sonoma County				
Asti				
Italian Swiss Colony	Ponds	Winery	Land	0.25
Fulton				
Fulton Processors	Ponds	Poultry Processing	Land	0.16
Geyserville				
PG&E Geysers Power Plant	Primary	Power	Big Sulphur Creek	0.90
Healdsburg				
Paul Mariani	Septic Tanks	Dehydrator	Land	0.002
Seghesio Winery	Ponds	Winery	Land	Unknown
Standard Structures	Pond	Wood Products	Healdsburg Creek	Unknown
Santa Rosa				
Harry E. Rasmussen	Ponds	Dairy	Land	0.001
Reliable Sand and Gravel Co.	Unknown	Gravel Plant	Unknown	Unknown
Santa Rosa Poultry Co.	Unknown	Poultry Processing	Laguna De Santa Rosa	Unknown
Sebastopol				
Dicks Smoked Meat Products	Septic Tanks	Meat Processing	Land	Unknown
Windsor				
Mayfair Packing Co.	Unknown	Prune Packing	Windsor Creek	0.005
Redwood Ranch, Inc.	Unknown	Unknown	Windsor Creek	0.5
Graton				
Hallberg Apple Processing Plant	Pond	Apple Processing	Green Valley Creek	Unknown
Hunt Foods, Inc.	Unknown	Vinegar Mfg.	Green Valley Creek	Unknown
Manzuna Food Products	Unknown	Apple Processing	Green Valley Creek	Unknown
Malina				
Malina Coop.	Unknown	Cannery	Green Valley Creek	Unknown
Sebastopol Coop. Cannery #2	Pond	Apple Processing	Green Valley Creek	Unknown
Silverra and O'Connell	Pond	Unknown	Green Valley Creek	Unknown
Sebastopol				
Gold Ridge Products	Unknown	Cannery	Laguna De Santa Rosa	Unknown
Pleasant Hill Coop.	Unknown	Cannery	Laguna De Santa Rosa	Unknown
Sebastopol Processing Coop.	Pond	Apple Processing	Laguna De Santa Rosa	Unknown

source performed at the same time indicated a moderately hard (108 ppm) water that was Class 2 (good to injurious) irrigation water, due to the concentration of boron (0.9 ppm).

Minor Industrial Waste Water Discharges

Most of the industrial waste water discharges in the Russian River watershed are small in volume and seasonal in operation. This is particularly true of the wineries and food processing industries.

Many of the smaller industrial waste water discharges are listed in Table 30. Other information such as flow, treatment provided, method of disposal and type of industry are listed where known. Small industrial waste water discharges that may not be included in the listing probably dispose of waste water on land by evaporation and percolation.

Present Waste Water Reclamation Practices

Generally, the reuse of waste water is practiced because the supply of domestic, industrial, or agricultural water is inadequate. However, this is not the case in the Russian River watershed where presently there is an adequate supply of unused water for all purposes. Here, the primary reason for the reuse of waste water effluent for beneficial purposes is to offset the cost of additional treatment required to satisfy pollution control requirements.

There are two types of waste water reclamation. Planned or deliberate reclamation is the recovery of all or part of the water in a domestic or industrial waste discharge for direct beneficial use, through maintenance of control. Incidental reclamation is the recovery of water from a domestic or industrial waste discharge subsequent to the discharge of the waste and without specific engineering control.

Planned Reclamation

There are six major dischargers in the Russian River watershed that reclaim some effluent from waste water treatment plants for irrigation purposes. Table 31 lists these dischargers and the annual volume of effluent reused from 1962 to 1965.

TABLE 31

MAJOR PLANNED RECLAMATION OPERATIONS, 1962-65

Discharger	Discharge Acre-Ft/Year	Effluent Reused Acre-Ft/Year	Percent of Total Flow	Use
City of Healdsburg	560	2	< 1	Plum Orchard
Mendocino State Hospital	670	505	75	Corn, Alfalfa
City of Santa Rosa	6,270	73	1	Pasture
City of Ukiah	2,580	12	< 1	Pasture, Alfalfa
City of Sebastopol	560	239	43	Pasture
Masonite Corporation	1,900	Unknown	Unknown	Irrigation

Incidental Reclamation

Incidental waste water reclamation occurs when the waste water is discharged into bodies of fresh water or into ground water (land discharges), and the receiving water is subsequently extracted for a beneficial use. In most cases, the waste water loses its identity through dilution and removal of organic constituents by biological action in the stream or the soil. Table 32 lists the major waste water dischargers in the watershed area which, by virtue of their locations, are subject to incidental reclamation.

TABLE 32

INCIDENTAL RECLAMATION

Discharger	Discharge (mgd)	Irrigation Class	Type of Treatment	Use
City of Healdsburg	0.5	2	Secondary	Downstream Supply
Mendocino State Hospital	0.6	1	Secondary	Ground Water
City of Santa Rosa	5.6	2	Secondary	Downstream Supply
City of Ukiah	1.6	1	Secondary	Downstream Supply
City of Sebastopol	0.5	2	Secondary	Downstream Supply
City of Cloverdale	0.4	2	Secondary	Downstream Supply
Masonite Corporation	1.7	1	Primary1/	Ground Water & Downstream Supply

1/ Some dissolved solids removal.

CHAPTER X. POTENTIAL WATER QUALITY PROBLEMS

The surface waters of the Russian River Basin presently are experiencing water quality problems created by both man and nature. In this chapter, the important sources of degradation are discussed and an attempt has been made to assess their relative magnitude.

Man-made Sources of Degradation

Human beings and their activities are the major source of water quality degradation in the Russian River watershed. Man-made causes of degradation are of greater importance than natural causes.

Waste Disposal

Waste disposal is the major source of surface water quality degradation in the study area. Treated municipal wastes from the cities of Ukiah, Cloverdale, Healdsburg, Sebastopol, and Santa Rosa are discharged to the Russian River or its tributaries during the winter and spring months. Santa Rosa's effluent reaches the river near Mirabel Park during the entire year. During periods of low flow in the late summer and fall, a large percentage of the water in the lower reach of the river is treated waste water. Untreated wastes from apple processing plants near Sebastopol are discharged to tributaries of the Laguna de Santa Rosa and Green Valley Creek during the packing season. Complaints from residents of Graton indicate that in the fall, a severe odor problem exists along Atascadero Creek. Coliform counts and ABS concentrations in the Laguna de Santa Rosa area are nearly always in violation of the north Coastal Regional Water Quality Control Board's "Water Pollution Control Policy of the Russian River Basin" (Resolution No. 59). The pollution overload in this area also is indicated by the low dissolved oxygen concentrations found in the Laguna and in Green Valley Creek.

Phytoplankton (mostly unattached algae) production is the most important quality problem resulting from disposal of municipal waste water in the Russian River and its tributaries. The constantly increasing quantities of treated waste water reaching the main river are aggravating this problem in the lower reach of the river. Excessive algal production is caused by nutrients (mostly nitrates and phosphates) in the treated waste water. Local resort owners in this area state that the heavy algae blooms which occur during the summer months discourage water-contact recreation and hurt the economy of the area. Algae can cause unpleasant taste and odor in water supplies, clog filters in industrial and municipal treatment plants, interfere with manufacturing processes, decrease the supply of fish because of reduction in dissolved oxygen concentration, and discourage many recreational water uses.

Many of the communities in the watershed use individual septic tanks for waste disposal. So far, the problem of waste from septic tanks leaching into the surface waters in objectional quantities has not occurred. However, continued population growth in these unsewered areas will create this problem, particularly in river front communities located downstream from Mirabel Park. Effluent from most septic tanks eventually reaches the ground water. If the quantity of waste water is large enough, the mineral content of the ground water is increased. Most of the wineries in the watershed dispose of their waste by ponding on percolation beds. This water eventually reaches the ground water beneath the ponds and in time can degrade its quality.

Return quantities of irrigation water appear to be small and presently have no appreciable effect on surface water quality. However, many vineyards are now being located on hillsides of Mendocino County that formerly were pasture land or dry-farmed. These vineyards are being spray irrigated and the excess water flows down the slopes and into tributaries of the Russian River. If the irrigated acreage continues to increase, the quality of the Russian River water could be impaired by nutrients and pesticides commonly found in the irrigation return water. There has also been a report of erosion resulting from this irrigation. Efficient irrigation practices can greatly reduce volumes of irrigation return water.

Dairy wastes, from the many dairies on the Santa Rosa Plain, are a problem because they frequently discharge directly to surface water channels. Because of the intermittent nature of such discharges, they are often hard to detect. A more intensive study of the disposal of dairy wastes is needed.

Presently, users of surface waters depend on the assimilative and dilution capacity of the receiving waters to make them suitable and safe for use. This capacity is limited and indications are that this limit has been exceeded in some tributaries and approached in the lower reach of the Russian River.

Erosion

Erosion generally results either directly or indirectly from man and his activities. During periods of high precipitation, material from eroded land washes into natural watercourses raising the turbidity of the water. High turbidity can cause siltation which destroys fish-spawning areas. Turbidity also interferes with fishing and water-contact sports.

The Russian River, like most of California's large coastal rivers, is very turbid following periods of heavy precipitation. After the construction of Coyote Dam in 1958, complaints about excessive turbidity became so numerous that a Steering Committee, composed of representatives of various interested governmental agencies, was formed to study the erosion problem. At the request of this committee, the United States Geological Survey began an investigation in the fall of 1964 to determine the magnitude of the problem and recommend a solution.

A comparison of turbidity values, obtained by the Department of Water Resources' basic data program, along the main stem of the river before and after the dam was built, shows that after a period of heavy precipitation, the single level outlet at Lake Mendocino prolongs the periods of high turbidity downstream from the dam. However, peak values of turbidity for a given storm are generally lower downstream than upstream from the dam. The percentage of samples showing turbidity values of less than 10 units decreases downstream, indicating that turbidity increases with distance away from the dam during dry weather flows. This may result from scouring action or tributary inflows.

Sand and Gravel Operations

Sand and gravel operations in the riverbeds of the watershed are responsible for some of the turbidity in the surface waters. Several large gravel companies operate in the reach of the Russian River between Healdsburg and Mirabel Park. Others operate along Forsythe Creek in Mendocino County and along Green Valley Creek in Sonoma County.

Increased turbidities usually develop whenever gravel removal operations occur in the riverbed itself, and often persist for several days after the work has ceased.

Construction Activities

Construction activities also increase the turbidity of downstream water. Alteration of the vegetation on stream banks or steep slopes caused by road building or construction can increase erosion and attendant problems. Such activities should be planned carefully and, prior to actual construction, provision should be made for control of possible erosion.

Logging Activities

Logging activities formerly were an important cause of erosion in many of California's coastal drainage areas. Most logging concerns now leave sufficient forest cover to retard erosion and they also clean up any debris resulting from logging operations. Debris left on the forest floor can find its way into natural drainage channels where it can become a log-jam barrier to fish attempting to reach spawning areas. None of these conditions were observed within the Russian River watershed.

Impoundments

Impoundments of water can create water quality problems. If thermal stratification develops, biological processes normally occurring near the bottom of a reservoir will completely consume the dissolved oxygen content of the water in the lower stratum. If this condition develops, the pH of the lower stratum drops and iron and manganese from the reservoir floor goes into solution. If this low dissolved oxygen water is released from the reservoir into a downstream channel, the channel is then unsuitable for fish life.

Lake Mendocino does develop low dissolved oxygen values in its bottom layers, but water released from the lake appears to be completely reaerated by the time it has traveled about 200 yards downstream from the dam. Following a rainstorm, the turbidity of water in Lake Mendocino appears to be very slow to settle. To reduce the turbidity of the main stem, releases from the reservoir are often reduced following a rainstorm. However, because of the persistence of the turbidity, later release of this water merely lengthens the time the main stem remains turbid. Future reservoirs in the Russian River Basin should be constructed with multiple level outlets to allow water to be released from the reservoir at various levels, depending on the turbidity of the water. The single level outlet at Coyote Dam prevents the release of the less turbid layers of water which exist in the reservoir.

Recreation

Recreation, though often closely associated with impoundments, can cause water quality problems of its own. The increasing population in California and the greater amount of leisure time available to residents results in a heavy demand for water-contact recreation. Most existing bodies of water and any new bodies of water are put to greater and greater recreation use. The recreationists demand a clear, high quality water, but often the water quality is degraded by the activities of the recreationists themselves.

To keep an intensively used water-contact recreation area fit for enjoyment, some sort of maintenance program is required. Adequate sanitary facilities and provisions for trash collection and removal are necessary in such areas. Power boat operation creates possible problems concerned with fuel and oil spills, including taste and odor problems in water and fish flesh.

Although an attempt is being made to provide a proper maintenance program around Lake Mendocino, it was observed during this study that some fishermen continue to abandon unused bait along the shoreline. The resort area in the lower reach of the river generally is well maintained, but considerable trash is dumped in the middle reach of the river by recreationists and others.

Natural Causes of Degradation

Seepage of poor quality ground water can seriously alter the dissolved mineral content of surface water. There are many highly mineralized springs discharging to surface waters on the west side of the Mayacmas Mountains. The Geysers Power Plant, operated by Pacific Gas and Electric Company, uses steam from some of these springs and discharges the spent condensate to Big Sulphur Creek. None of these springs is large enough to seriously change the water quality of the Russian River, but several small tributaries show adverse effects of such spring discharge. Sulphur Creek, near Ukiah, receives discharge from Vichy Springs and shows increases in specific conductance in excess of 200 percent and boron concentration in excess of 1,000 percent in water flowing past the springs. (See Chapter VI, Table 17.)

The ground water in certain areas of Sanel Valley contains boron in concentrations greater than the local crops will tolerate. This boron may be rising from deep-seated waters which are known to be under pressure and which have a boron content of nearly 600 ppm after reaching ground surface.

Flooding occurs frequently in the lower reach of the Russian River and can affect the quality of ground water in the flooded area.

Flooded wells are often unusable for some time after a storm because they must be cleaned and resterilized. The silt deposited in these areas is easily resuspended and can continue to erode for some time after the flood recedes.

CHAPTER XI. MAINTENANCE AND IMPROVEMENT OF WATER QUALITY

The present mineral quality of ground and surface waters within the Russian River watershed is excellent with the exception of several small tributary streams and some small pockets of ground water. There is no reason to expect any significant mineral quality degradation in the future except possibly in a few isolated local areas. Maintenance of the present mineral quality of the Russian River and its tributaries will allow the continued use of the water for all beneficial uses.

The major water quality problem within the watershed is due to biological activity. Discharges of sewage effluent into the Russian River and its tributaries result in high coliform counts and high nutrient (mostly nitrates and phosphates) concentrations, which stimulate excessive phytoplankton growths. Improvement of the biological water quality of the lower Russian River is necessary to prevent public health hazards and conditions that tend to discourage water contact sports.

Proposed Water Quality Objectives

The purpose of water quality objectives is to establish guidelines for the protection of beneficial uses of the waters concerned. Water quality objectives for the Russian River watershed will be established on the basis of the beneficial uses outlined by the North Coastal Regional Water Quality Control Board in Resolution No. 59, as follows:

> "WHEREAS, the California Department of Water Resources has designated the waters of the Russian River, its branches and tributary streams as subject to development for beneficial use under the California Water Plan, and;

"WHEREAS, the California Department of Public Health has stated that water for domestic and municipal supply and for water-contact sports should be protected in the interest of public health, and;

"WHEREAS, the California Department of Fish and Game has designated the waters of the Russian River, its branches and tributary streams as a principal natural spawning and nursery area for salmon, steelhead, trout, and shad and as an important habitat for other resident fishes, and;

"WHEREAS, it is in the public interest to protect and maintain the quality of the waters of the Russian River, its branches and tributary streams unimpaired, be it, therefore

"RESOLVED, that the North Coastal Regional Water Quality Control Board does hereby establish the beneficial uses of the waters of the Russian River, its branches and tributary streams to include domestic, municipal, agricultural, and industrial water supply, navigation, fish and wildlife propagation and habitat, water-oriented recreational activities including swimming, wading, boating and fishing, plus certain aesthetic values."

The entire text of Resolution No. 59 appears in Appendix B along with requirements imposed on various waste water discharges within the watershed.

The objectives of Resolution No. 59 included the requirement that sewage-bearing waste water effluents discharged to surface water within the watershed should be disinfected at all times so that the median MPN of coliform organisms would not exceed 50 per 100 ml. Waste water discharges were not allowed to reduce the dissolved oxygen (DO) concentration of receiving waters below 7 ppm where the waters were determined to have an inherent DO in excess at this value, or cause the pH to be depressed below 6.5 or to increase above 8.5. Alkyl Benzene Sulfonate (ABS) concentrations greater than 0.5 ppm were prohibited in the receiving waters. Other requirements, including those regarding turbidity and temperature, appear in Appendix B.

The objectives of Resolution No. 59 were primarily concerned with bacterial and physical parameters of water quality. The objectives were well suited for the present protection of the stated beneficial uses of the Russian River and its tributaries.

Long range objectives for individual chemical, physical, and biological water quality parameters are proposed by the Department of Water Resources to aid the Regional Board in protecting present and future beneficial uses.

Table 33 lists the proposed water quality objectives for the Russian River and its tributaries. Also shown are various water quality criteria for beneficial uses and the range of values for some water quality parameters, recorded since 1951 at three stations on the Russian River.

The proposed surface water objectives are for the Russian River as measured at Guerneville. Water passing by this sampling station contains drainage from all of the hydrographic subunits within the watershed except

TABLE 33

LONG TERM OBJECTIVES FOR SPECIFIC PARAMETERS OF WATER QUALITY

Parameter	CRITERIA LIMITS			OBSERVED RANGE - During Investigation Unless Otherwise Noted				PROPOSED OBJECTIVES
	Drinking Water	Recreation and Fish and Game	Irrigation (Class 1)	Russian River at Guerneville	Russian River at Healdsburg	Russian River at Hopland	Russian River System	Limiting Values as Measured at Guerneville
Arsenic (ppm)	0.01							0.01
Biochemical Oxygen Demand (ppm)								1.0
Boron (ppm)			0.5	0.0-3.0 1/	0.0-4.3 1/	0.0-0.8 1/	0-49	0.5
Chloride (ppm)	250		175	1.0-13 1/	1.5-14 1/	1.5-10 1/	0.5-107	14
$Chromium^{+6}$ (ppm)	0.05							0.05
Coliform Bacteria (MPN/100 ml)	1	1000						1000
Color (units)	15							15
Copper (ppm)	1.0	0.02						0.02
Detergents as ABS	0.5						0-1.8	0.5
Dissolved Oxygen (ppm)		5-9		8.3-11.8	8.0-13.3	9.0-11.8	0.1-29.3	≥ 7
Fluoride (ppm)	0.8-1.5 4/							1.0
Hardness (ppm as $CaCO_3$)				86-146	99-134	69-99	43-300	160
Hydrogen Ion Concentration (pH)		$\geq 7.0 \leq 8.5$		7.4-8.2	7.6-8.4	7.0-8.2	6.7-9.4	$\geq 7.0 \leq 8.5$
Iron (ppm)	0.3			0.01-0.62	0.01-0.24	0.00-0.70	0.0-6.8	0.3
Lead (ppm)	0.05							0.05
Manganese (ppm)	0.05			0.01-0.18	0.00	0.01-0.21	0.00-0.84	0.05
Nitrate (ppm)	45			0.4-2.8	0.2-2.0	0.8-1.6	0-64	2.1
Pesticides (ppm)								7/
Phenols (ppm)	0.001							0.001
Phosphate								
Ortho (ppm)				0.18-0.41	0.04-0.21	0.04-0.21	0.02-22	0.25
Total (ppm)				0.37	0.05-0.09	0.05-0.15	0.01-30	
Sodium (%)			60	11-23 1/	10-36 1/	10-34 1/	10-83	24
Specific Conductance (micromhos)			1000	82-381 1/	90-344 1/	93-274 1/	82-1750	400
Sulfate (ppm)	250			13-15	14	10-13	0-54	16
Temperature (°F)		32-65		47.5-78	41-78	48-74	38.5-95	2/
Total Dissolved Solids (ppm)	500		700	130-162	121-154	98-119	84-769	240
Turbidity								
Hach (JTU)	5			< 5-140	< 5-91	< 5-92	< 5-375	5 3/
Hellige (ppm SiO_2)	5			5.8-8.5	1.9-40	1.5-22	0.05-52	5
Heavy Metals Not Shown Above 5/								6/

1/ Based on recorded values from 1951-66
2/ Proposed objective - at a nonharmful level for cold water fish
3/ Dry weather
4/ See Table 13
5/ Aluminum, Berylium, Bismuth, Cadmium, Cobalt, Gallium, Germanium, Molybdenum, Nickel, Titanium, Vanadium, Zinc
6/ Proposed objective - at nontoxic levels
7/ See text, page 135

Austin Creek. Since the water from Austin Creek subunit is of excellent quality and has few potential sources of pollution or contamination, it probably will not adversely affect the quality of water in the Russian River.

Proposed objectives for most of the water quality parameters were set at the limiting value for the most demanding beneficial use. However, historical high values recorded for some of the parameters were well below any criteria limits. The parameters of percent sodium, electrical conductivity, and concentrations of total dissolved solids, sulfates, and chlorides were in this category. Establishment of objectives for these parameters essentially equal to the existing levels will assure maintenance of the present excellent mineral quality of the Russian River and its tributaries. Therefore, the objectives for percent sodium, electrical conductivity, and concentrations of sulfates and chlorides were set at levels based on the prevailing distribution of maximum, median and minimum value for each parameter since 1951 in the Russian River at Guerneville. The objective for total dissolved solids was set at 0.6 of the objective for electrical conductivity (See Figure 4, p. 58).

No objectives were set for pesticides. The significance of pesticide data is not fully understood at present. Levels previously thought to be safe may be harmful due to the ability of humans and members of the aquatic food chain to concentrate persistent pesticides (primarily chlorinated hydrocarbons) in their tissues. Concentrations of pesticides in the Russian River at Guerneville are presently very low, indicating that relatively small amounts reach surface waters in the watershed. Surveillance should be continued and if there is any sharp increase in pesticide concentrations, the cause should be determined.

Excessive phytoplankton growths in the lower Russian River were attributed to high nutrient concentrations that supported the large amounts of phytoplankton transported into the river from Mark West Creek. The high nutrient concentrations also stimulated further phytoplankton growth in the lower Russian River.

Objectives for nutrient concentrations should be set to prevent excessive phytoplankton growths. By limiting nutrient concentrations, phytoplankton population will not be eliminated but could be reduced to non-nuisance levels. Numerous researchers and investigators have reported that excessive phytoplankton production in water can be avoided if concentrations of nitrogen and phosphorus are held to low values. In order to limit phytoplankton production, generally accepted ranges for these constituents are as follows: nitrate nitrogen below 0.3 ppm (1.33 ppm as NO_3), total nitrogen below 0.6 ppm, and phosphate between 0.018 ppm and 0.09 ppm.(26) Most surface waters in the watershed contain nitrogen and phosphorus in excess of these limiting values. Nitrogen may not be a limiting factor since some phytoplankton can obtain it from the atmosphere when it is unavailable in sufficient quantities in the water. Under present conditions of development, it would be unrealistic to set objectives for nutrient concentrations at the accepted limiting values.

The objectives for nutrients in the Russian River at Guerneville must be lower than the existing levels in order to reduce excessive phytoplankton growths in the lower Russian River. Realistic values were determined by basing the objectives on the amounts of nutrients in the Russian River above the confluence of Mark West Creek and hence upstream from most of the nutrient-bearing waste discharges into the river (See Figure 6).

The objective for phosphates in the Russian River at Guerneville was set at a value roughly equivalent of the highest concentration recorded during the investigation in the Russian River above the confluence of Mark West Creek (See Figure 6). The value so determined was 0.25 ppm, as orthophosphate.

The objective for nitrogen was set in the same manner as that for phosphates. The resulting value was 2.1 ppm, as nitrate.

Methods of Meeting Proposed Water Quality Objectives

Presently, most surface waters in the watershed meet the proposed water quality objectives for all parameters. Some of the waters do not meet the proposed objectives for certain parameters because of natural degradation. For example, high boron concentrations in Sulphur Creek and Big Sulphur Creek are caused by seepage of highly mineralized water. It is generally not feasible to control degradation of this type.

In a few areas of the watershed, the proposed water quality objectives for certain parameters are not presently being met because of man-made degradation. Most man-made degradation takes place in the lower Russian River and the streams in the Laguna area where beneficial water uses are impaired by waste water discharges from the Santa Rosa Valley. Significant degradation of this type can and should be eliminated because of the large extent of water-oriented recreation in the watershed. Water-oriented recreation has been estimated to contribute seven million dollars annually to the economy of the watershed.(31) Future prospects are that this contribution will increase.

Control of waste disposal operations will contribute the most to improving water quality where needed, and insure that the waters presently meeting the proposed water quality objectives continue to do so. Two other activities that will enable waters in the watershed to meet and continue to meet the proposed water quality objectives are dam and reservoir construction and turbidity control.

The North Coastal Regional Water Quality Control Board can control the waste discharges as a part of its normal regulatory activities. The Regional Board can also regulate turbidity caused by construction and gravel operations, but control of turbidity caused by erosion is beyond the scope of the Board's operations. Most significant dam and reservoir construction and operation in the watershed is by the United States Army Corps of Engineers.

Presently, the regulatory actions of the Regional Board can assure that the proposed water quality objectives are met. Existing waste water requirements should continue to be enforced to the full extent of the law. In the future, some type of overall water quality management program, under the direction of an agency with basinwide authority, may be necessary.

Waste Disposal

The problems caused by waste disposal in the Russian River watershed are increasing. Virtually, all of the problems are caused by domestic waste water. Presently, about 11.0 mgd of waste water are discharged in the watershed. The total volume of waste water discharged in the watershed in 1980 can be estimated by assuming a per capita contribution. The per capita waste water contribution can be assumed to be roughly equal to the per capita water consumption. If consumption data for only the months of December through March are used, most water that is not normally discharged into sanitary sewers (lawn-watering, car-washing, etc.) will not influence the computations. The Department of Water Resources' actual water consumption data for various cities in the watershed (35) were used to compute an average per capita domestic waste water contribution of 102 gallons per day. The population in the watershed is expected to increase by 120 percent from 1960 to 1980.(32) This would result in a population of about 236,000 in 1980. Therefore, the estimated volume of waste water discharged into the watershed in 1980 would be about 24.1 mgd.

Most of the waste water in the watershed comes from the Santa Rosa Valley. This situation will continue in the future. By 1980, the projected population of the Santa Rosa Valley will be about 149,000, a 154 percent increase from 1960.(32) Therefore, assuming an average waste water contribution of 102 gallons per capita per day, the projected volume of waste water discharged in the Santa Rosa Valley in 1980 will be about 15.2 mgd. These estimates of future waste discharge volumes are at best "rough" since per capita waste contributions depend upon many unknown factors, including availability of water, cost of water, standard of living, and air temperature.

Presently, the most serious problem caused by waste water disposal within the watershed is excessive phytoplankton growth which is stimulated by nutrients in the waste discharges. This phytoplankton makes the water undesirable for water-oriented recreation. Most excessive phytoplankton growth occurs in the lower Russian River, downstream from the waste water discharges from the Santa Rosa Valley. The proposed objectives for nutrients are generally exceeded in the lower Russian River during the summer. As waste discharges increase, phytoplankton growth will become more of a problem and could eventually ruin the extensive water-oriented recreation industry of the lower Russian River.

The most logical solutions to the problem of excessive phytoplankton growth are either to prevent waste discharges from reaching the Russian River and its tributaries or to remove the nutrients from the waste water discharges.

Waste Water Disposal in the Santa Rosa Valley. The Santa Rosa Valley is a good location for construction of waste water disposal facilities on a regional basis. Methods of disposal that would be too costly for individual cities or communities would be feasible on a regional basis. The cost of treating a unit volume of waste water decreases as the volume treated increases. For example, a primary treatment plant with separate sludge digestion and a capacity of 1 mgd would cost about $230,000 per mgd of capacity to construct. A similar plant with a capacity of 10 mgd would only cost about $90,000 per mgd to construct.(17) Operating and sewerage costs follow a similar cost/capacity relationship.

A master plan for waste water disposal in the Santa Rosa Valley was proposed in a report titled Collection, Treatment, and Disposal of Sewage and Industrial Wastes Within the Santa Rosa Plain. (31) This report was transmitted to the Sonoma County Board of Supervisors in July 1962 by M. Carleton Yoder, Consulting Engineer.

The master plan proposed in the Yoder report was flexible, and provided for waste water disposal, either to the ocean or within the watershed.

Facilities for waste water disposal to the ocean would include a sewer line along the Russian River serving the cities of Windsor, Healdsburg, Guerneville, and communities along the lower Russian River. The raw domestic waste water would be transported to a treatment plant near the ocean and discharged through an ocean outfall. Industrial wastes would be treated at various existing plants and discharged within the watershed.

A treatment plant and pumping station, known as the Laguna Plant, would be built at the west end of Millbrae Avenue, about six miles southwest of Santa Rosa. The Laguna Plant would serve the Piner-Olivet Area (west of Santa Rosa), part or all of the Santa Rosa area, Rohnert Park, Cotati, and Sebastopol. The existing City of Santa Rosa treatment plant would probably be abandoned.

Raw waste water from the pumping station at the Laguna Plant would be pumped through a sewer line along Salmon Creek to Bodega Head for treatment and disposal to the ocean. Twenty mgd of raw waste water could be treated at the Laguna treatment plant and reclaimed for irrigation during the summer, if suitable agricultural land is maintained in the Laguna area. Existing treatment facilities could be used for industrial waste treatment with discharge within the watershed.

Disposal of all waste water within the watershed would involve sewering the communities along the lower Russian River back to a treatment plant near the confluence of Mark West and Windsor creeks. This plant would also serve the cities of Windsor and Healdsburg. Effluent would either be used for irrigation or discharged to Mark West Creek, if appropriate treatment could be provided.

The effluent from the Laguna treatment plant would also be used for irrigation or discharged to the Laguna de Santa Rosa. The existing

City of Santa Rosa treatment plant would be doubled in size and continue to serve a portion of the city.

The Sonoma County Board of Supervisors is implementing the master plan for waste disposal that was proposed in the Yoder report. The county is constructing the facilities in stages and using slightly different trunk sewer alignments. The Laguna Plant has already been constructed and began operating in December of 1967. A new waste water treatment plant has recently been built to serve the City of Windsor. Because of this, some alteration of the master plan proposed in the Yoder report may be necessary.

The master plan proposed in the Yoder report should allow the long-range water quality objectives proposed by the Department of Water Resources to be attained. However, the planned facilities will not be completed in the immediate future. A serious problem exists now, because of excessive amounts of phytoplankton growths in the lower Russian River. The problem will continue until all nutrient-bearing waste water discharges are eliminated from the Russian River, particularly during the summer.

Waste water discharges within the Santa Rosa Valley will not be possible in the future unless there are either some technological advances that will make nutrient removal more economical, or sufficient land remains available to irrigate with the effluent. The Sonoma County Board of Supervisors should schedule the implementation of the master plan proposed in the Yoder report so that all nutrient-bearing waste water discharges are eliminated from the Russian River and its tributaries as soon as possible.

The most effective method of reducing nutrient concentrations in the lower Russian River is to reclaim all of the effluent from treatment plants in the Santa Rosa area (Santa Rosa, Laguna, and Sebastopol treatment plants). According to the Yoder report, as much as 20 mgd of waste water could be used for irrigation in the Laguna area during the summer.(31) This would accommodate all of the flow from the Santa Rosa area until an ocean outfall could be constructed. Waste water in the Windsor-Healdsburg area could possibly be reclaimed near the respective treatment plants. Effluent from the City of Healdsburg's plant is presently retained in ponds in the dry bed of Dry Creek during the summer. When the Warm Springs Dam begins releasing summer flows into Dry Creek, these ponds will be inundated and summer discharge to the creek will not be permissible under the present regulations of the Regional Water Quality Control Board.

Large scale waste water reclamation operations should be closely controlled and monitored. No adverse affects on usable ground waters should be permitted. Also, there should be adequate safeguards to protect the public health.

Waste disposal facilities for new housing developments or industries should be planned for eventual incorporation into the master plan proposed in the Yoder report. A large number of small waste treatment facilities in the Santa Rosa Valley should be avoided because they would be uneconomical and adequate control over the discharges would be different.

Waste Water Disposal in Areas Outside of the Santa Rosa Valley. Areas outside of the Santa Rosa Valley, particularly in the Mendocino County portion of the watershed, are generally sparsely populated and individual communities are far apart. The City of Ukiah, the largest of these, has a population of about 11,000. To effectively meet the long-range water quality objectives proposed by the Department of Water Resources, particularly for nutrients, waste water from these communities cannot be discharged into the Russian River unless adequately treated. Adequate treatment would have to include removal of nutrients.

The communities along the lower Russian River were included in the master plan proposed in the Yoder report.(31) Waste water from many smaller communities, and from isolated homes, is discharged into septic tanks and then to subsurface leaching fields for disposal. There are two alternatives for waste water disposal by the remaining communities outside of the Santa Rosa Valley: (1) discharge of treated effluents to the Russian River, or its tributaries, after nutrient removal, or (2) land disposal of effluents by either percolation and evaporation, or irrigation.

Nutrient removal under present technology is probably too costly for these smaller communities. The distance between them precludes development of treatment facilities on a regional basis.

The most practical method of disposing of waste water from communities outside of the Santa Rosa Valley is by discharge to land. Most of these communities, including the City of Ukiah, presently retain all waste water effluents on land during the period from Memorial Day to Labor Day. The vacant land surrounding these communities and the relatively low volumes of waste water assure that land disposal will be possible for a long time. During the winter, when natural runoff is high, treated effluents could be discharged into the Russian River and its tributaries, if necessary.

Waste water reclamation operations should be closely controlled and monitored by the Regional Water Quality Control Board. Most communities outside of the Santa Rosa Valley withdraw domestic water supplies from ground water basins. It is important to prevent any adverse effects on these ground waters by waste water reclamation operations.

Dam and Reservoir Construction

Dams and reservoirs in the Russian River watershed are constructed primarily for flood control and water supply. However, normal operation usually results in a significant improvement in downstream water quality. Excellent quality water stored during winter runoff may be released during the summer period of low natural flow. These low summer flows may be of poor mineral quality. Dilution by the stored water may significantly improve the quality of downstream waters. In some instances, streams that are normally dry during the summer may contain water because of upstream reservoir releases.

Lake Mendocino, impounded by Coyote Dam, is the one significant reservoir presently existing in the Russian River watershed. It has a 122,500-acre-foot storage capacity. In Department of Water Resources' Bulletin No. 3, The California Water Plan published in May 1957, fourteen additional dams and reservoirs were discussed as development possibilities for the watershed. Included was the enlargement of Lake Mendocino to its ultimate storage capacity of 199,000 acre-feet. Potential dams and reservoirs were on Franz Creek, Maacama Creek, Big Sulphur Creek, Cummisky Creek, Feliz Creek, Robertson Creek, Sausal Creek, Dry Creek, Warm Springs Creek, East Austin Creek, and two projects on Mark West Creek. Two of these reservoirs are currently in various stages of development. Warm Springs Dam has been authorized and is planned for completion about 1968 and Knights Valley Reservoir is proposed for construction at some later date.

Warm Springs Dam. Warm Springs Dam will be located near the confluence of Warm Springs Creek and Dry Creek. It will impound a reservoir (Lake Sonoma) with 277,000 acre-feet of controlled storage capacity.

Water impounded by the dam will be of excellent mineral quality. The only potential water quality problem connected with this project would be from moderately high boron concentrations (2.3 ppm maximum) found in Warm Springs Creek during the summer. However, this problem will be taken care of by dilution with Dry Creek water which has a low boron content the year-round.

An electrical conductivity recorder was installed on Dry Creek, below the confluence of Warm Springs Creek. The expected electrical conductivity from the reservoir was determined by prorating the data from the recorder according to flow. The anticipated electrical conductivity is 130 micromhos, well below the limit for Class 1 (excellent to good) irrigation water.

Releases from the reservoir will allow the projected supplemental water requirements of Sonoma County, southern Mendocino County, and Marin County to be met until about 1995.

Knights Valley Reservoir. Knights Valley Reservoir will involve two separate dams, one on Franz Creek and one on Maacama Creek. The dams will be high enough to form a common reservoir at higher stages. The reservoir will be located about six miles east of Healdsburg and will extend to the eastern boundary of the Russian River watershed. The reservoir will impound the natural flows of Franz and Maacama creeks and provide storage for surplus water diverted from the Russian River.

The Corps of Engineers proposes to construct the reservoir either in three stages or to ultimate capacity in one stage. If constructed in stages, the first stage would consist of a 233,000-acre-foot reservoir with a yield of 45,000 acre-feet available for use in the Napa Valley. The second stage, consisting of facilities to divert surplus water from the Russian River to the then existing reservoir, would provide 109,000 acre-feet of new water yield. The third stage would consist of raising Maacama and Franz dams to impound a storage reservoir of 1,500,000 acre-feet and increasing the conveyance capacity of the diversion facilities to provide an additional yield of 196,000 acre-feet. The ultimate reservoir yield would be 350,000 acre-feet per year.

The Bureau of Reclamation is also studying the project. It will be responsible for marketing the agricultural water yielded from the reservoir.

The mineral water quality in the reservoir should be excellent. Water diverted from the Russian River will be excellent quality and Class 1 irrigation water with respect to all parameters.

Operation of Completed Reservoirs. Releases from Coyote Dam allow minimum flows of 125 cfs in the Russian River at Guerneville even when diversions are being made for domestic, irrigation, and industrial use. However, the fixed level of the outlet at the dam is the cause of minor water quality problems which often occur. During summer stratification, for instance, iron concentrations as high as 3.5 ppm were recorded downstream from the dam.

When construction of Warm Springs Dam is completed, releases from its reservoir will provide flow in Dry Creek during the summer. A minimum flow of about 25 cfs will be maintained in the creek. Optimum flows would depend primarily on flood regulation and would vary during the year. Summer flows in the creek will prevent the City of Healdsburg from using the creekbeds for oxidation and percolation ponding under present requirements.

Consideration should be given to using multiple level outlets in Warm Springs Dam to facilitate quality control. Quality control of the releases from the dam would enhance the fishery in Dry Creek.

The proposed Knights Valley Reservoir will allow higher minimum summer flows in Maacama Creek than presently exist. Summer flows will also be possible in Franz Creek which now is dry during summer months. Minimum flows of 10 cfs in Maacama Creek and 5 cfs in Franz Creek are recommended by the State Department of Fish and Game, for the period June 1 to October 31. The Corps of Engineers has confirmed that it will be possible to maintain these flows.

Turbidity Control

Control of turbidity in the Russian River watershed will protect the fishery resources and generally enhance water-oriented recreation in the watershed. High turbidity levels caused by construction or logging operations in the river and creekbeds can smother fish spawning grounds or obscure the river bottom in swimming areas discouraging water-contact sports.

Presently, logging activity in the watershed does not significantly increase turbidity; numerous gravel and construction operations that are carried on in and near streambeds do. Some gravel mining is done in the Russian River bed during low flows. Natural erosion also causes turbidity in the watershed, particularly during heavy rainfall.

Properly planned and executed construction of roads, subdivisions, and buildings, can help to control man-made land erosion and resulting silt-loads in streams. The following procedures are recommended by the State Department of Fish and Game for control of construction activities:

1. Do not allow oily or greasy substances, or other material harmful to fishlife originating from the contractor's operations, to enter or be placed where they will later enter a live stream.
2. Maintain a 50-foot wide buffer strip on either side of a stream in which noncommercial vegetation is disturbed as little as possible.
3. Construct a crossing which will allow unobstructed flow of the stream when repeatedly crossing the stream with heavy equipment.
4. Fell trees away from streams and keep debris out of stream during clearing operations.
5. Divert runoff from steep erodable surface into low erosion hazard surface.
6. Make frequent water checks on roads or cat-tracks when work is finished to reduce erosion.
7. On steep hillside sections (slopes greater than 60 percent) near a body of water, the road should be cut into the solid hillside and the waste material placed in selected spoil areas where overcast will not fall directly into stream channel.

Strict control over gravel operations can reduce excessive turbidities in adjacent rivers and streams. This is particularly true when gravel operations are located in riverbeds. Turbidity requirements and monitoring procedures should be established by the Regional Board for all gravel operations.

Natural erosion can be controlled by the planting of a cover-crop, terracing and channeling, and construction of check dams and settling ponds.

The cover-crop should be a fast growing type. After the slopes are stabilized, a more permanent, slowly growing type of vegetation can be planted, particularly if water is available for irrigation.

Terracing can be used on slopes too steep for cover-crops. Runoff should be directed into gently sloping drainage channels. Where the gradient of the runoff is excessive, check dams and settling ponds are effective.

Surveillance Program for Water Quality

Water quality in a stream system is never static; it is continuously changing, for better or for worse. Furthermore, quality may be improving in one reach while deteriorating in another. Therefore, it is an essential part of quality management to devise surveillance techniques to record, or preferably to predict, any significant quality changes in the stream system.

The Russian River is well suited to a quality monitoring program. Since 1951, the Department of Water Resources has taken monthly or bimonthly samples at four stations on the river to analyze for physical and chemical content. The sampling stations are spotted along the entire length of the watershed at these locations: East Fork Russian River at Potter Valley, Russian River near Hopland, Russian River near Healdsburg, and Russian River at Guerneville. In addition, nutrient determinations (NO_3, NO_2, NH_4, PO_4) are presently performed on samples taken bimonthly at the Guerneville station.

The recommended minimum monitoring program includes continuation of this surface water sampling program. In addition, the following measures would greatly aid in detection of significant water quality changes as they occur in the Russian River watershed:

1. Nutrient analyses of samples from the Russian River near Healdsburg and at Guerneville.
2. Phytoplankton analyses of samples from the Russian River near Healdsburg and at Guerneville concurrently with the nutrient analyses.
3. Continued intermittent visual inspections of the entire stream system by the staff of the Regional Water Quality Control Board.
4. Monitoring the effects on usable ground waters of waste water discharges to land.
5. Intensive follow-up surveillance to determine the cause of any significant water quality changes that may occur.

Visual observations often prove as valuable as laboratory analyses. For example, a physical inspection may disclose the presence of oil or other floating materials, fish kills, or the source of an unknown waste discharge. Color film is effective for recording such observations. Periodic unscheduled inspections and photographic evidence of violations may have a psychological impact on the area which could lead to more conscientious observance of pollution control methods and operations.

Appendix A

BIBLIOGRAPHY

BIBLIOGRAPHY

Books

1. American Public Health Association, American Water Works Association, Water Pollution Control Federation. Joint Publication. Standard Methods for the Examination of Water and Wastewater. 12th edition, 1965.

2. Jackson, Daniel F. Algae and Man. New York: Plenum Press, 1964. (Based on lectures presented at the NATO Advanced Study Institute July 22-August 11, 1962, Louisville, Kentucky.)

3. Macar, T. T. Fresh Water Ecology. London: Langmans, Green and Co., Ltd., 1963.

4. Sawyer, Clair N. Chemistry for Sanitary Engineers. New York: McGraw-Hill Book Co., Inc., 1960.

5. Steel, Ernest W. Water Supply and Sewerage. New York: McGraw-Hill Book Co., Inc., 1960.

6. Welch, Paul S. Limnology. New York: McGraw-Hill Book Co., Inc., 1952.

7. Welch, Paul S. Limnological Methods. New York: McGraw-Hill Book Co., Inc., 1960.

Public Documents

8. Allen, E. T. and Day, A. L. Steam Wells and Other Thermal Activity at the Geysers, California. Carnegie Institute of Washington. Publication No. 378. 1927.

9. California State Department of Water Resources. Directory of Water Service Agencies in California. Bulletin No. 114. June 1962.

10. California State Department of Water Resources. Land and Water Use in Russian River Hydrographic Unit. Bulletin No. 94-11. November 1964.

11. California State Department of Water Resources. Recommended Water Well Construction and Sealing Standards: Mendocino County. Bulletin No. 62. November 1958.

12. California State Department of Water Resources. Sea Water Intrusion in California; Appendix B: Report by Los Angeles County Flood Control District. Bulletin No. 63B. March 1957.

13. California State Department of Water Resources. The California Plan. Bulletin No. 3. May 1957.

14. California State Department of Water Resources. Water Resources and Future Requirements North Coastal Hydrographic Area, Volume I: Southern Portion. Bulletin 142-1. April 1965.

15. California State Water Quality Control Board. Water Quality Criteria. McHee and Wolf. Publication No. 3A. 1963.

16. U. S. Department of Agriculture. Explanation and Interpretation of Analyses of Irrigation Waters. Circular No. 784. 1948.

17. U. S. Geological Survey. Geology and Ground Water in the Santa Rosa and Petaluma Valley Areas, Sonoma County, California. G. T. Cardwell. Water Supply Paper 1427. 1958.

18. U. S. Geological Survey. Geology and Ground Water in Russian River Valley Areas and in Round, Laytonville, and Little Lake Valleys, Sonoma and Mendocino Counties, California. Water Supply Paper 1548. 1965.

19. U. S. Geological Survey. Springs of California. G. A. Waring. Water Supply Paper 338. 1915.

20. U. S. Geological Survey. Study and Interpretation of the Chemical Characteristics of Natural Water. J. D. Hem. Water Supply Paper 1473. 1959.

21. U. S. Department of Health, Education and Welfare. Limnological Aspects of Recreational Lakes. Publication No. 1167. 1964.

22. U. S. Department of Health, Education and Welfare. Modern Sewage Treatment Plants - How Much Do They Cost. Publication No. 1229. 1964.

23. U. S. Public Health Service. Algae in Water Supplies. Publication No. 657. 1959.

24. U. S. Public Health Service. Drinking Water Standards. Publication No. 956. 1962.

25. U. S. Public Health Service. Nitrogen and Phosphorus in Water. Publication No. 1305. 1965.

26. U. S. Public Health Service, Region IX. Preliminary Report on the Future Municipal and Industrial Water Uses and Future Water Quality Control Flows. March 1963.

Reports

27. California State Department of Water Resources. Water Quality and Biologic Conditions in South Bay Aqueduct 1962-1966. June 1967.

28. California State Division of Water Resources. Effects of Winery Wastes Disposal on Ground Water, Sonoma County. (Report to North Coastal Water Quality Control Board.) June 1952.

29. California State Division of Water Resources. Flow and Quality Characteristics of the Russian River. Water Pollution Investigation, Report No. 2. January 1951.

30. Stone and Youngberg. Municipal Finance Consultants. Control and Use of Russian River Water. Prepared for the Board of Directors, Sonoma County Flood Control and Water Conservation District. February 1954.

31. Yoder, Carleton M., Consulting Engineer. Collection, Treatment, and Disposal of Sewage and Industrial Wastes Within the Santa Rosa Plain. Prepared for the Sonoma County Board of Supervisors. July 1962.

Unpublished Material

32. Brackett, Glenn. "Suitability of Water Conditions for Angling Use in the Russian River - Winter 1964-65." Resources Agency of California, Department of Fish and Game, Inland Fisheries, Region 3. (Administrative Report.)

33. California State Department of Public Health, Bureau of Sanitary Engineering. "Russian River Survey." March 1964. (Unpublished Report.)

34. California State Department of Water Resources. "Geologic Conditions and Occurrence and Nature of Ground Water in the Russian River Hydrographic Unit." San Francisco Bay District, Investigation Unit. 1963. (Office Report.)

35. California State Department of Water Resources. "Municipal and Industrial Water Use, San Francisco Bay District." San Francisco Bay District, Land Water Use Unit. 1965. (Office Report.)

36. California State Department of Water Resources. "Quality of Water: Russian River and Mendocino Coast Hydrographic Units." San Francisco Bay District, Water Quality Unit. April 1963. (Office Report.)

37. Day, John S. "The 1959 Limnological Survey at Lake Mendocino, Mendocino County in Relation to Fish Management." Resources Agency of California, Department of Fish and Game, Inland Fisheries, Region 3. (Mimeographed.)

38. Marliave, C. "Geologic Report on Ground Water Conditions in the Vicinity of Santa Rosa Naval Air Station, Sonoma County, California." June 1944. (Mimeographed.)

39. U. S. Army Corps of Engineers, San Francisco District. "Russian River Basin, California Economic Base Study." July 1962. (Mimeographed.)

Appendix B

WATER QUALITY CONTROL POLICY OF THE RUSSIAN RIVER BASIN

(Resolution No. 59 North Coastal Regional Water Quality Control Board)

RESOLUTION NO. 59

WATER QUALITY CONTROL POLICY OF THE

RUSSIAN RIVER BASIN

Amended 2/9/67

WHEREAS, the waters of the Russian River, its branches and tributary streams are a resource belonging to all the people of California;

WHEREAS, Section 13000, Chapter 1, Division 7 of the California Water Code provides that: "The Legislature finds and declares that it is necessary to the health, safety and welfare of the people of this State to provide means for co-ordinating the actions of the various state agencies and political subdivisions of the State in the control of water pollution and the maintenance of water quality.

The Legislature further declares that it is necessary to provide means for the regional control of water pollution since problems of water pollution in this State are primarily regional and dependent upon factors of precipitation, topography, population, and recreational, agricultural and industrial development which vary greatly from region to region, and to provide for co-ordinated statewide control of water quality since water quality is a matter of statewide interest and concern.", and;

WHEREAS, Section 13000.1, Division 7 of the California Water Code provides that: "In conformity with Section 3 of Article XIV of the Constitution of the State and with Section 100, which require that the water resources of the State be put to beneficial use to the fullest extent of which they are capable and that the waste or unreasonable use or unreasonable method of use of water be prevented, the Legislature finds and declares, that the people of the State have a primary interest in the control and conservation of the water resources of the state and the prevention of damage thereto by unreasonable use", and;

WHEREAS, Section 13000.2, Division 7 of the California Water Code provides that: "The Legislature finds and declares that, because of the widespread demand and need for the full utilization of the water resources of the State for beneficial uses, it is the policy of the State that the disposal of waste into the waters of the State shall be so regulated as to achieve highest water quality consistent with maximum benefit to the people of the State and shall be controlled so as to promote the peace, health, safety and welfare of the people of the State.", and;

WHEREAS, Subsection (e), Section 13052., Division 7 of the California Water Code provides that each Regional Board, with respect to its origin shall:.. "formulate and adopt long-range plans and policies with respect to water pollution control within its region in conformity with the policies set forth in Chapter I (commencing at Section 13000)", and;

WHEREAS, Section 13003, Chapter 1, Division 7 of the California Water Code declares that: "It is the intent of the Legislature that the State Water Quality Control Board and each regional water pollution control board shall cooperate with the Department of Water Resources and other State agencies in all matters of mutual concern to the fullest extent practicable", and;

WHEREAS, the California Department of Water Resources has designated the waters of the Russian River, its branches and tributary streams as subject to development for beneficial use under the California Water Plan, and;

WHEREAS, the California Department of Public Health has stated that water for domestic and municipal supply and for water-contact sports should be protected in the interest of public health, and;

WHEREAS, the California Department of Fish and Game has designated the waters of the Russian River, its branches and tributary streams as a principal natural spawning and nursery area for salmon, steelhead, trout, and shad and as an important habitat for other resident fishes, and;

WHEREAS, it is in the public interest to protect and maintain the quality of the waters of the Russian River, its branches and tributary streams unimpaired, be it, therefore

RESOLVED, that the North Coastal Regional Water Pollution Control Board does hereby establish the beneficial uses of the waters of the Russian River, its branches and tributary streams to include domestic, municipal, agricultural, and industrial water supply, fish and wildlife propagation and habitat, navigation, water-oriented recreational activities including swimming, wading, boating and fishing, plus certain aesthetic values, and, be it

RESOLVED further, hat the North Coastal Regional Water Pollution Control Board does hereby prescribe the following water pollution control objectives in order to protect and maintain the quality of the waters of the Russian River, its branches and tributary streams unimpaired for all of its present and potential beneficial uses and to insure the maximum benefit to the people of the State:

1. There shall be no discharge of sewage other than sewage effluent meeting the standards prescribed herein into the waters of the Russian River, its branches or tributary streams.

2. Discharge of sewage, sewage effluent, or industrial waste including agricultural waste shall not cause a pollution of usable ground or surface waters of the Russian River Basin.

3. Sewage effluent or industrial waste including agricultural waste discharged into the waters of the Russian River, its branches and tributary streams shall not contain concentrations of materials which are detrimental to human, plant, animal or aquatic life.

4. There shall be no discharge into the waters of the Russian River, its branches and tributary streams of garbage, refuse, cans, bottles, paper, swill, vegetable matter, petroleum products, carcasses of dead animals, offal from a slaughter pen or butcher shop, rubbish, sawdust, chips, logs, lumber, bark, shavings, edgings or any other material which will impair the quality of the receiving waters for any of their beneficial uses nor shall any such material in quantity that will cause a condition of pollution be discharged or allowed to be discharged upon the banks or left in other places where such material might be expected to be carried or washed into the waters of the Russian River, its branches or tributary streams.

5. Any sewage effluent reaching the waters of the Russian River shall be adequately disinfected to protect enunciated beneficial uses. Effluent shall be considered adequately disinfected if either of the following conditions are met:

    1. Any treated effluent reaching the Russian River shall have been held for a period of not less than 60 days, or

    2. Any effluent reaching the Russian River with less than a minimum of 60 days holding shall be disinfected to meet the following bacteriological standards:

       At some point in the treatment process the effluent shall be so disinfected that the median most probable number of coliform organisms shall not exceed 50 per 100 ml. A method other than bacteriological testing will be acceptable if a statistically reliable correlation is demonstrated between bacteriological results and the alternate testing method.

6. The discharge of sewage effluents or industrial waste including agricultural waste shall not cause the dissolved oxygen content of the waters of the Russian River, its branches or tributary streams to be reduced below a minimum of seven parts per million where such receiving waters have previously been determined to inherently have in excess of this amount. In the event tests indicate that the receiving waters have a dissolved oxygen content of less than 7 parts per million prior to the introduction of waste effluents, said effluents shall not reduce the dissolved oxygen content below the existing level.

7. The discharge of sewage effluents or industrial waste including agricultural waste shall not cause the pH of the waters of the Russian River, its branches and tributary streams to be depressed below 6.5 nor to increase above 8.5.

8. Neither a sewage treatment facility nor sewage effluent or industrial waste shall cause a public nuisance in the Russian River Basin due to odors or unsightliness.

9. The discharge of sewage effluent or industrial waste including agricultural waste shall not cause a public nuisance in the waters of the Russian River, its branches and tributary streams due to color, odor, taste, foam, concentrations of floating or suspended solids, visible oil or grease slicks and shall not cause a concentration of Alkyl Benzene Sulfonate in excess of 0.5 part per million in the receiving waters.

10. The discharge of sewage effluents or industrial waste including agricultural waste shall not cause bottom deposits or unsightly slimes, fungus or algal growths in the waters of the Russian River, its branches and tributary streams.

11. The discharge of sewage effluent or industrial waste including agricultural waste shall not increase the turbidity of the waters of the Russian River, its branches and tributary streams at a point 500 feet below the discharge more than 5 units if the receiving waters above the discharge indicate turbidities of 0 to 50 units; 10 units if the receiving waters indicate turbidities of 50 to 100 units; ten percent if the receiving waters indicate turbidities in excess of 100 units.

12. The waters of the Russian River, its branches and tributary streams shall not be impaired for beneficial usage because of an increase or decrease in temperature caused by an industrial waste discharge including discharges from water conservation, hydroelectric, flood control, and recreation reservoirs, canals, aqueducts, pipelines, irrigation drainage canals or ditches or any other man-made structure or facility.

All laboratory tests for determining compliance with the above objectives shall be determined in accordance with the latest edition of <u>Standard Methods for the Examination of Water and Waste Water</u>.

The foregoing water pollution control objectives for the Russian River Basin may be revised from time to time if conditions change.

Appendix C

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

RUSSIAN RIVER AT DUNCANS MILLS (Station 1)
7N/11W - 14F

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen % Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents [b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hach / Hellige	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																		
7-6-65 1240		72	8.9	101	343	8.1 / 8.5	32 / 1.60	18 / 1.46	12 / 0.52	1.9 / 0.05	6 / 0.20	169 / 2.77	17 / 0.35	9.5 / 0.27	0.3 / 0.00	0.0 / 0.00	0.4		PO_4 = 0.35 ABS = 0.0 Fe = 1.4	175	14	153	4	25	DWR
9-29-65 1330		67	10.3	111	290	8.2 / 8.5	2.74[c]				6 / 0.20	150 / 2.46		8.4 / 0.24	1.1 / 0.02				PO_4 = 0.61			137	4	24	DWR
10-28-65 1230		64	9.6	100	295	8.2						159 / 2.61												3	Field Determination
12-16-65 1415		49	10.7	93	289	7.7 / 8.2	2.52[c]				0 / 0.00	144 / 2.36		8.7 / 0.24	1.7 / 0.03				PO_4 = 0.28			126	8	14	DWR
1-20-66 1100		49	10.8	94.1	291	8.1	2.88[c]				0 / 0.00	144 / 2.36		7.5 / 0.21	3.3 / 0.06				PO_4 = 0.23			144	26	18	DWR
3-3-66 1010		49	11.5	100	212	7.5 / 8.3	27	30			0 / 0.00	114 / 1.87		4.0 / 0.11	1.9 / 0.03		0.2			131		193	100	100	DWR
4-14-66 1430		66	10.0	107	242	8.1	2.16[c]					134		5.7 / 0.16	2.8 / 0.04				PO_4 = 0.34 (Ortho)			108		52	DWR
5-9-66 1015		66	8.9	95.1	260	7.9						159		6.4 / 0.18	2.4 / 0.04				PO_4 = 0.34 (Ortho)					5 / 3.5	DWR
6-6-66 1035		65	9.3	98.3	330	8.2	2.48[c]					201		9.1 / 0.26	1.8 / 0.03				PO_4 = 0.49 (Ortho) Fe = 0.98			124		12 / 7.7	DWR
7-18-66 1100		73	7.8	89.9	300	8.0 / 8.3	2.76[c]				0 / 0.00	166 / 2.72		7.4 / 0.21	0.9 / 0.01		0.4		PO_4 = 0.46 (Ortho) Fe = 0.76 Mn = 0.16			138	2	30 / 5.2	DWR
8-18-66 0945		71	7.5	84.6	290	8.0						232		7.4 / 0.21	0.4 / 0.01		0.4		PO_4 = 0.35 (Ortho) Fe = 0.67 Mn = 0.00	144				21 / 6.3	DWR

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hach turbidity in Jackson Turbidity Units using Hach Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

AUSTIN CREEK (STA. 2)

7N/11W - 11C

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents [b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hach / Hellige	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																		
7-6-65 1220	1/2	68	8.5	92.9	278	7.7 / 8.3	26 / 1.30	18 / 1.44	8.2 / 0.36	1.1 / 0.03	0 / 0.00	167 / 2.74	7.2 / 0.15	8.1 / 0.23	0.5 / 0.01	0.0 / 0.00	0.0		PO_4 = 0.07 Color= 0 Fe = 0.07	144	12	137	0	<5	DWR
9-29-65 1300	1/2	65.5	8.3	88.3	280	7.6 / 8.5	2.84[a]				6 / 0.20	157 / 2.57		8.3 / 0.23	0.4 / 0.01				PO_4 = 0.07			142	3	<5	DWR
10-28-65 1200	1/2	66	9.5	102	300	8.3	24 / 1.20	20.7 / 1.70			0 / 0.00	159 / 2.61										145	15	<5	Field Determination
12-16-65 1500	10	47.5	12.3	105	270	8.0 / 8.5	2.56[a]				3 / 0.10	146 / 2.39		7.7 / 0.22	0.2 / 0.00				PO_4 = 0.06			128	3	<5	DWR
1-20-66 1030	30	45	11.7	96.6	293	7.9	2.96[a]				0 / 0.00	166 / 2.72		8.0 / 0.22	0.6 / 0.01				PO_4 = 0.07			148	12	<5	DWR
3-2-66 0940	75	46	12.2	102	218	7.5 / 8.6	18	15			7 / 0.23	117 / 1.92		4.7 / 0.13	0.4 / 0.01		0.0			126		107	11	9	DWR
4-14-66 1410	4	65	10.1	107	235	8.2	2.22[a]					146		4.8 / 0.14	0.0 / 0.00				PO_4 = 0.08 (Ortho)			111		1.5	DWR
5-9-66 0950	4	59	9.3	91.8	250	7.8						171		6.3 / 0.18	0.6 / 0.01				PO_4 = 0.09 (Ortho)					5 / 1	DWR
6-9-66 0955	2	60	9.2	91.9	295	7.7	2.24[a]					183		7.2 / 0.20	0.4 / 0.01				PO_4 = 0.08 (Ortho)			112		<5 / 0.3	DWR
7-18-66 1030	1	68	6.1	66.7	220	7.5						195												<5 / 0.3	Field Determination
8-18-66 0850	1/2	65	5.0	52.9	300	7.3						189		7.8 / 0.22	0.0 / 0.00				PO_4 = 0.06 (Ortho) Fe = 0.02 Mn = 0.02	152				<5 / 0.05	DWR

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hach turbidity in Jackson Turbidity Units using Hach Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

RUSSIAN RIVER AT GUERNEVILLE (STATION 3)
8N/10W - 35B

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen % Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents [b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hoch / Hellige	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																		
7-6-65 1130	212	74	10.2	119	330	8.1																		30	Field Determination
7-14-65 1030	193	75	11.0	129	314	8.2 / 8.5	2.92[c]		12 / 0.52		6 / 0.20	160 / 2.62		7.6 / 0.21			0.3				15	146	5	17	USGS
9-15-65 0830	275	68	10.8	118	270	8.0 / 7.9	32 / 1.60	11 / 0.94	10 / 0.44	1.2 / 0.03	0 / 0.00	154 / 2.52	13 / 0.27	6.6 / 0.19	2.0		0.3	13		160	15	127	1	10	USGS
9-29-65 1225	219	70	9.7	108	270	8.1																		28	Field Determination
10-28-65 1130	211	67	9.1	98.3	290	8.2						146 / 2.39												10	Field Determination
11-9-65 0713	380	59	8.5		327	7.6 / 8.2	2.58[c]		18 / 0.78		0 / 0.00	154 / 2.52		14 / 0.39			0.4				23	129	3	5	USGS
12-16-65 1535	761	47.5	11.1	94.9	290	7.7 / 8.2	2.54[c]				0 / 0.00	144 / 2.36		8.7 / 0.24	2.8 / 0.04				PO_4 = 0.37 Fe = 0.01			127	9	8	DWR
1-11-66 0700	8080	48	11.8	102	197	7.4 / 7.8	1.72[c]		6.8 / 0.30		0 / 0.00	98 / 1.61		4.0 / 0.11							15	86	6	140	USGS
1-20-66 1140	1770	49	10.8	94.1	260	7.9																		12	Field Determination
3-3-66 1045	3200	50	11.7	103	211	7.5						122												98	DWR
3-30-66 0830		58	11.6	113	287	7.6 / 8.2	2.62[c]		10 / 0.44		0 / 0.00	157 / 2.57		5.2 / 0.15			0.2				14	131	2	3	USGS
4-14-66 1525	1060	66	10.8	116	245	8.2	2.24[c]					146		6.0 / 0.17	2.4 / 0.04				PO_4 = 0.37 (Ortho) ABS = 0.0			112		30	DWR

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hoch turbidity in Jackson Turbidity Units using Hoch Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

RUSSIAN RIVER AT GUERNEVILLE (STATION 3)

8N/10W - 35B

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents [b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity[d] in ppm Hach / Hellige	Analyzed by[e]
5-3-66 0800	30	59	8.4	83	288	7.6/7.8	28/1.40	15/1.22	11/0.48	1.1/0.03	0/0.00	156/2.56	15/0.31	6.1/0.17	2.0/0.03		0.3	13	ABS = 0.0 PO_4 = 0.41 (Ortho)	162	15	131	3	4/–	USGS
5-9-66 1050	592	64.5	9.3	97.7	260	8.0						165							PO_4 = 0.40 (Ortho)					5/8.5	DWR
6-6-66 1135	185	68	10.1	110	350	8.2	/2.48[c]					201		9.3/0.26	1.9/0.03				PO_4 = 0.58 (Ortho)			124		12/7.7	DWR
7-12-66 1000	90	71	10.1	114	298	8.2/8.4			11/0.48		4/0.13	157/2.57		6.6/0.19			0.2				15	137	2	5	USGS
7-18-66 1135	154	78	9.0	109	280	8.2						165			0.4/0.01				PO_4 = 0.18 (Ortho) Mn = 0.18 ABS = 0.0 Fe = 0.49					28/5.8	DWR
8-18-66 1015	181	76	8.3	98.5	270	8.1						171		6.4/0.18	1.0/0.02				PO_4 = 0.35 (Ortho) Fe = 0.62 Mn = 0.01 ABS = 0.0	130				24/8.0	DWR

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hach turbidity in Jackson Turbidity Units using Hach Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

REGION 1

Date and time sampled	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO3)	Bicarbonate (HCO3)	Sulfate (SO4)	Chloride (Cl)	Nitrate (NO3)	Fluoride (F)	Boron (B)	Silica (SiO2)	Other constituents	Total Dissolved solids in ppm	Percent sodium	Hardness as CaCO3 Total ppm	Hardness as CaCO3 N.C. ppm	Turbidity in ppm	Coliform[d] MPN/ml	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																			
											Russian River at Guerneville															
1951																										
Apr 13 0910	793	61	9.0	90	268	7.6			11 / 0.48			148 / 2.43		6.0 / 0.169								124		15		USGS
May 8 0915	184	61	8.6	86	245	7.5	23 / 1.15	13 / 1.07	6.7 / 0.291	1.3 / 0.033	0 / 0.00	132 / 2.16	14 / 0.29	3.2 / 0.090	1.5 / 0.024		0.48	17		145	11	111	3			USGS
Jun 13 1005	120	74	8.8	102	381	7.8						174 / 2.85		6.1 / 0.172								128		25		DWR
Jul 11 1415	176	75	7.4	87	313	8.0						170 / 2.79		5.0 / 0.141								140		25		DWR
Aug 16 1850	176	77	9.0	107	301	8.0						176 / 2.88		10 / 0.28								142		25		DWR
Sep 9 1025	176	72	8.0	90	288	7.8	32 / 1.60	14 / 1.15	9.0 / 0.391	1.1 / 0.028	5.9 / 0.197	154 / 2.52	13 / 0.27	5.5 / 0.155	0.18 / 0.003	0 / 0.00	0.62	15		172[b]	12	137	14			USGS
Oct 9 0945	172	67	8.7	94	290	7.3			10 / 0.43		0 / 0.00	158 / 2.49		7.2 / 0.203							14	131	2	0		USGS
Nov 12 1515	1,970	60	10.6	105	278	7.6			12 / 0.52		0 / 0.00	151 / 2.47		8.2 / 0.231							17	124	0	10	23 0.62-620	USGS
Dec 10 1015	3,250	47	10.0	75	232	6.4						122 / 200		5 / 0.14								232		65		DWR
1952																										
Jan 9 1010	6,070	45	11.0	90	176	7.3					0 / 0.00	88 / 1.44		5 / 0.14								50		130		DWR
Feb 11 0935	3,980	52	10.0	90	221	7.5			7.3 / 0.317		0 / 0.00	116 / 1.90		4.5 / 0.127							14	100	5	60		USGS
Mar 6 1700	3,680	47	10.2	87	237	7.4			8.3 / 0.361		0 / 0.00	123 / 2.01		7.0 / 0.197							14	108	7	20		USGS
Apr 21 1010	1,020	61	10.6	106	250	7.8					0 / 0.00	144 / 2.36		5 / 0.14								122		7		DWR
May 19 1030	65	70	8.0	89	265	8.0	25 / 1.25	14 / 1.15	8.9 / 0.387	1.2 / 0.031	0 / 0.00	146 / 2.39	13 / 0.27	7.3 / 0.206	0.6 / 0.009	0.2 / 0.011	0.43	20	(a) Sn 0.10	162[b]	14	120	0			USGS
Jun 16 1015	369	73	8.7	100	247	8.6					1 / 0.03	146 / 2.39		7 / 0.20								122		7		DWR
Jul 7 1100	244	77	7.5	89	296	8.3					0 / 0.00	159 / 2.61		8 / 0.23								130		7		DWR

a Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and chromium (Cr), reported here as 0.0/0.00 except as shown.

b Determined by addition of analysed constituents

c Gravimetric determination.

d Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by Calif. Dept of Public Health, Division of Laboratories.

e Mineral analyses made by USGS, Quality of Water Branch (USGS), Pacific Chemical Consultant (PCC), Metropolitan Water District (MWD), Los Angeles Dept. of Water & Power (LAOWP), City of Los Angeles Dept of Pub Health (LAOPH), Long Beach Dept of Pub Health (LBDPH) & State Division of Water Resources (DWR), as indicated

ANALYSES OF SURFACE WATER

REGION 1

Date and time sampled	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity in ppm	Coliform[d] MPN/ml	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																			
											Russian River at Guerneville															
1952 (continued)																										
Aug 4 1050	224				261	7.8	24.4 / 1.22				0 / 0.00	153 / 2.51		12 / 0.34	.31 / .005							120		8		DWR
Sep 15 1115	198	70	7.2	80	260	7.7					0 / 0.00	149 / 2.44		5.3 / 0.149								116				USGS
Oct 6 1215	175	61	8.6	86	267	7.3	26 / 1.30	14 / 1.15	11 / 0.48	1.2 / 0.031	0 / 0.00	150 / 2.46	9.9 / 0.206	7.5 / 0.212	0.3 / 0.005		0.70	16	(a)	160[b]	16	122	0			USGS
Nov 7 0905	204	54	10.4	97	265	8.0					0 / 00.00	152 / 2.49		6 / 0.17								116		5		DWR
Dec 1 1650	3,380	47	11.2	95	249	6.7					0 / 0.00	106 / 1.74		7 / 0.20								95		250	3.7 0.13–2,400	DWR
1953																										
Jan 12 1010	11,900	58	10.0	97	171	6.4	15 / 0.75	8.9 / 0.732	7.4 / 0.321	1.6 / 0.041	0 / 0.00	88 / 1.44		5.2 / 0.147							17	74	0			USGS
Feb 9 1430	1,180	60	10.9	108	277	7.2	26 / 1.30	14 / 1.15	11 / 0.48	1.2 / 0.031	0 / 0.00	147 / 2.41		9.5 / 0.268							16	122	2			USGS
Mar 9 1205	685	56	10.3	98	262	7.3	25 / 1.25	13 / 1.07	10 / 0.43		0 / 0.00	140 / 2.29		6.0 / 0.169			0.47				16	116	1			USGS
Apr 6 1230	1,340	62	7.8	79	251	7.4	25 / 1.25	12 / 0.99	15 / 0.65		0 / 0.00	135 / 2.21		6.5 / 0.183			0.30				23	112	1	15		USGS
May 4 1330	402	56	8.4	101	237	7.2	22 / 1.10	13 / 1.07	9.6 / 0.417	1.4 / 0.036	0 / 0.00	125 / 2.05	13 / 0.27	7.2 / 0.203	1.4 / 0.023	0.2 / 0.011	0.24	17	Al 0.04; Fe 0.1 Zn 0.02 (a)	146[b]	16	108	6	35		USGS
Jun 8 1230	737	65	9.6	104	247	7.4					0 / 0.00	134 / 2.20		6 / 0.17			0.26				14	120		10		DWR
Jul 6 1220	326	78	8.6	94	247	7.6			9.2 / 0.400		0 / 0.00	139 / 2.28		6 / 0.17			0.54				14	119		10		DWR
Aug 3 1000	262	68	8.6	91	259	7.3	26 / 1.30	13 / 1.07	9.4 / 0.409	1.2 / 0.031	0 / 0.00	144 / 2.36		6.5 / 0.183			0.44				15	118	0	1		USGS
Sep 14 1230	246	80	7.4	50	252	8.4	24 / 1.20	13 / 1.07	10 / 0.43	1.2 / 0.031	0 / 0.00	140 / 2.29	9.8 / 0.204	6.0 / 0.169	0.6 / 0.010	0.1 / 0.005	0.33	14	Fe 0.01; Zn 0.02 (a)	148[b]	16	113	0	2		USGS
Oct 5 0955	267	74	4.3	96	245	7.9	24 / 1.20	7.8 / 0.641	11 / 0.48	1.2 / 0.031	0 / 0.00	141 / 2.31		1.0 / 0.028			0.40				20	92	0	5		USGS
Nov 2 0830	226	59	9.8	97	286	7.4			12.5 / 0.544		0 / 0.00	158 / 2.59		9 / 0.253			0.7				17	130		3		DWR

a Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and chromium (Cr), reported here as $\frac{0.0}{0.00}$ except as shown.

b Determined by addition of analyzed constituents

c Gravimetric determination

d Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by Calif. Dept of Public Health, Division of Laboratories

e Mineral analyses made by USGS, Quality of Water Branch (USGS), Pacific Chemical Consultant (PCC), Metropolitan Water District (MWD), Los Angeles Dept. of Water & Power (LADWP), City of Los Angeles Dept of Pub Health (LADPH), Long Beach Dept of Pub Health (LBDPH) & State Division of Water Resources (DWR), as indicated

ANALYSES OF SURFACE WATER

REGION 1

Date and time sampled	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity in ppm	Coliform[d] MPN/ml	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																			
											Russian River at Guerneville															
1953 (continued)																										
Dec 7 0910	1,280	54	10.0	93	227	6.8	21 1.05	11 0.90	9.6 0.417	1.4 0.036	0 0.00	115 1.88		6.5 0.183			0.42				17	98	3	31	14.6 0.06– 2,400	USGS
1954																										
Jan 4 1030	650	53	10.7	98	243	7.8	25 1.25	11 9.90	9.2 0.400	1.2 0.031	0 0.00	131 2.15		8.0 0.226			0.88				15	108	0	8		USGS
Feb 1 1115	4,050	55	9.8	92	210	7.6	19 0.95	11 0.90	6.5 0.283	1.2 0.031	0 0.00	109 1.79		4.2 0.118			0.16				13	93	3	42		USGS
Mar 1 0910	[illegible],080	56	9.7	92	245	6.5	22 1.10	14 1.15	9.4 0.409	0.9 0.023	0 0.00	128 2.10		5.0 0.141			0.19				15	112	8	23		USGS
Apr 5 0837	20,800	57	7.6	73	122	6.8	12 0.60	5.6 0.46	4.3 0.187	2.6 0.067	0 0.00	61 0.99		1.8 0.051			0.18				14	53	3	208		USGS
May 3 1005	1,340	61	9.0	94	263	7.3	25 1.25	13 1.07	8.6 0.374	1.0 0.026	0 0.00	138 2.26	12 0.25	5.7 0.161	0.7 0.011	0.2 0.011	0.29	15	Zn 0.03; (a) Fe0.02	149[b]	14	116	3	3		USGS
Jun 10 1030	516	51	10.0	101	264	7.8	27 1.35	13 1.07	8.8 0.383	1.1 0.028	0 0.00	144 2.36	11 0.23	6.8 0.192			0.63				14	121	3	14		USGS
Jul 12 0940	152	79	8.5	103	306	7.7	30 1.50	15 1.23	11 0.48	1.2 0.031	0 0.00	171 2.80		7.0 0.197			0.83				15	137	0	28		USGS
Aug 2 1300	136	77	[illegible]	100	314	7.4	35 1.75	13 1.07	12 0.52	1.4 0.036	0 0.00	174 2.85		8.5 0.240			1.1				15	141	0	6		USGS
Sep 13 1310	260	72	8.0	91	289	7.3	28 1.40	13 1.07	13 0.57	1.4 0.036	0 0.00	154 2.52	10 0.21	9.5 0.270	0.8 0.013	0.1 0.005	2.2	15	(a)	169[b]	18	123	0	2		USGS
Oct 4 1000	302	68	8.3	90	287	7.8	26 1.30	13 1.07	13 0.57	1.2 0.031	0 0.00	156 2.57		9.5 0.270			2.5	13			19	120	0	2		USGS
Nov 7 1015	228	56	12.2	116	267	7.3	28 1.40	14 1.15	14 0.61	1.4 0.036	0 0.00	159 2.61		12 0.34			2.3				19	127	0	4		USGS
Dec 6 1030	12,100		11.0		138	7.2	13 0.65	6.3 0.521	5.3 0.230	2.5 0.064	0 0.00	68 1.11		9.0 0.254			0.26				16	58	2	380	6.2 0.23– 2,400	USGS

a Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and chromium (Cr), reported here as $\frac{0.0}{000}$ except as shown.
b Determined by addition of analysed constituents
c Gravimetric determination.
d Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by Calif Dept of Public Health, Division of Laboratories
e Mineral analyses made by USGS, Quality of Water Branch (USGS), Pacific Chemical Consultant (PCC), Metropolitan Water District (MWD), Los Angeles Dept. of Water & Power (LAOWP), City of Los Angeles Dept of Pub Health (LADPH) Long Beach Dept of Pub Health (LBDPH) & State Division of Water Resources (DWR), as indicated

ANALYSES OF SURFACE WATER

REGION 1

Date and time sampled	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity in ppm	Coliform[d] MPN/ml	Analyzed by[e]
												Russian River at Guerneville														
1955																										
Jan 3 1320	2,050	50	10.3	91	185	7.1	18 / 0.898	9.0 / 0.742	6.7 / 0.291	1.4 / 0.036	0 / 0.000	95 / 1.557		4.8 / 0.135			0.24				15	82	4	55		USGS
Feb 7 0930	1,320	44	11.1	90	251	7.4	24 / 1.198	13 / 1.082	10 / 0.435	1.1 / 0.028	0 / 0.000	132 / 2.163		7.0 / 0.197			0.32				16	144	6	10		USGS
Mar 1 1200	1,680	48	15.4	132	225	8.4	17 / 0.848	13 / 1.032	10 / 0.435	1.5 / 0.038	0 / 0.000	112 / 1.836		8.0 / 0.226			0.57				18	94	2	30		USGS
Apr 4 1000	421	56	10.2	97	312	7.9	29 / 1.447	15 / 1.233	15 / 0.652	1.3 / 0.033	0 / 0.000	170 / 2.786		10 / 0.282			1.4				19	134	0	6		USGS
May 2 0900	2,060	60	9.0	90	237	6.9	23 / 1.148	12 / 0.992	9.0 / 0.391	1.2 / 0.031	0 / 0.000	126 / 2.065	14 / 0.291	6.5 / 0.183	0.9 / 0.015	0.1 / 0.005	0.28	16	Mn 0.01; (a) PO_4 0.25	145[b]	15	107	4	20		USGS
Jun 24 0950	212	74	8.0	93	305	7.6	30 / 1.497	15 / 1.207	13 / 0.565	1.3 / 0.033	0 / 0.000	170 / 2.786		9.9 / 0.279			1.8		Al 0.05 (a)		17	135	0	0.8		USGS
Jul 11 0900	186	76	8.2	97	313	7.3	28 / 1.398	16 / 1.302	15 / 0.652	1.3 / 0.033	0 / 0.000	174 / 2.852		11 / 0.310			2.4				19	135	0	2		USGS
Aug 1 0950	148	74	8.2	95	318	8.1	27 / 1.347	16 / 1.353	15 / 0.652	1.4 / 0.036	0 / 0.000	181 / 2.966		12 / 0.336			2.6				19	135	0	7		USGS
Sep 12 1215	148	76	8.2	97	312	8.2	23 / 1.148	18 / 1.472	15 / 0.652	1.4 / 0.036	0 / 0.000	169 / 2.770	11 / 0.229	12 / 0.338	1.2 / 0.019	0.0 / 0.000	2.6	15	Al 0.07; Cu 0.02; (a)	182[b]	20	131	0	5		USGS
Oct 3 1300	181	70	9.0	100	308	7.2	26 / 1.297	14 / 1.167	16 / 0.696	1.4 / 0.036	0 / 0.000	163 / 2.672		12 / 0.338			3.0				22	123	0	4		USGS
Nov 14 1200	257	50	8.2	72	280	6.9	26 / 1.297	12 / 1.027	15 / 0.652	1.3 / 0.033	0 / 0.000	152 / 2.491		10 / 0.282			1.5				22	116	0	1		USGS
Dec 5 0940	363	50	7.5	66	276	6.8	27 / 1.347	12 / 0.993	14 / 0.609	2.5 / 0.064	0 / 0.000	136 / 2.229		10 / 0.282			1.1				20	117	5	30		USGS
																									median 17	
																									minimum .23	
																									maximum 7000	

a Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and chromium (Cr), reported here as $\frac{0.0}{0.00}$ except as shown.

b Determined by addition of analysed constituents

c Gravimetric determination.

d Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by Calif. Dept of Public Health, Division of Laboratories.

e Mineral analyses made by USGS, Quality of Water Branch (USGS), Pacific Chemical Consultant (PCC), Metropolitan Water District (MWD), Los Angeles Dept of Water & Power (LADWP), City of Los Angeles Dept of Pub Health (LADPH), Long Beach Dept of Pub Health (LBDPH) or State Division of Water Resources (DWR), as indicated

ANALYSES OF SURFACE WATER

REGION 1

Date and time sampled	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total Dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity in ppm	Coliform[d] MPN/ml	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																			
							Russian River at Guerneville																			
1956																										
Jan 16 0930	52,700	53	10.1	93	107	6.6	10 0.499	4.9 0.401	3.7 0.161	1.2 0.031	0 0.000	59 0.967		1.8 0.051			0.05				15	45	0	1000		USGS
Feb 17 1430	1,610	47	10.5	89	291	6.6	28 1.397	14 1.171	12 0.522	1.3 0.033	0 0.000	158 2.590		6.3 0.178			0.77				17	128	0	25		USGS
Mar 5 0950	4,610	52	10.2	93	211	6.9	20 0.998	11 0.882	7.9 0.344	1.5 0.038	0 0.000	115 1.885		6.2 0.175			0.50				15	94	0	80		USGS
Apr 2 0950	1,180	57	9.9	95	267	8.6	22 1.098	15 1.222	13 0.566	1.3 0.033	0 0.000	154 2.524		6.0 0.169			1.2				19	116	0	10		USGS
May 7 0940	1,200	63	8.6	89	231	7.8*	27 1.347	10 0.849	12 0.522	1.5 0.038	0 0.000	138 2.262	12 0.250	6.2 0.175	1.5 0.024	0.3 0.016	0.87	19	Fe 0.06; Al 0.06; Cu 0.01; As 0.01; PO_4 0.30; (a)	158	19	110	0	15		USGS
June 11 1230	327	76	8.8	104	305	7.4	27 1.347	18 1.485	15 0.652	1.6 0.041	0 0.000	165 2.704		10 0.282			1.7				18	142	7	5		USGS
July 2 0820	183	74	7.8	90	318	8.0	30 1.497	16 1.343	15 0.652	1.5 0.038	0 0.000	181 2.967		10 0.282			2.1				18	142	0	3		USGS
Aug 6 1030	158	78	8.2	99	322	7.3	29 1.447	17 1.413	16 0.696	1.5 0.038	0 0.000	184 3.016		12 0.338			2.9				19	143	0	3		USGS
Sept 11 0820	163	72	9.6	109	304	6.9	27 1.347	15 1.225	15 0.652	1.4 0.036	0 0.000	171 2.803	9.C 0.187	11 0.310	0.4 0.006	0.0 0.000	2.7	17	Al 0.05; Cu 0.01; Zn 0.01; PO_4 0.05; (a)	182[b]	20	129	0	1.0		USGS
Oct 18 1000	214	64	9.0	94	274	8.0	27 1.347	13 1.093	12 0.522	1.1 0.028	0 0.000	162 2.655		7.4 0.209			1.2				17	122	0	1		USGS
Nov 4 1620	422	59	10.6	104	256	7.6	24 1.198	12 1.010	11 0.478	1.8 0.046	0 0.000	135 2.213		6.3 0.178			0.70				17	110	0	30		USGS
Dec 3 0920	205	51	10.4	93	307	7.9	30 1.50	15 1.20	13 0.57	1.5 0.04	0 0.000	172 2.82		9.8 0.28			0.63				17	135	0	0.7		USGS
																									median 18	
																									minimum .23	
																									maximum 620	
*Lab pH																										

a Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and chromium (Cr), reported here as $\frac{0.0}{0.00}$ except as shown.

b Determined by addition of analysed constituents

c Gravimetric determination.

d Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by Calif. Dept of Public Health, Division of Laboratories.

e Mineral analyses made by USGS, Quality of Water Branch (USGS), Pacific Chemical Consultant (PCC), Metropolitan Water District (MWD), Los Angeles Dept. of Water & Power (LADWP), City of Los Angeles Dept of Pub Health (LADPH), Long Beach Dept of Pub Health (LBDPH) or State Division of Water Resources (DWR), as indicated

ANALYSES OF SURFACE WATER

NORTH COASTAL REGION

Date and time sampled	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH [f]	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm [b]	Per cent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity in ppm	Coliform [d] MPN/ml	Analyzed by [e]
							Mineral constituents in parts per million / equivalents per million																			
1957							RUSSIAN RIVER AT GUERNEVILLE																			
1/7 0920	605	48	10.0	86	323	8.0	31 1.55	16 1.29	14 0.61	1.3 0.03	0 0.00	178 2.92		11 0.31			0.84				18	142	0	0.8		USGS
2/4 0900	837	48	11.4	98	281	7.6	26 1.30	15 1.21	11 0.48	1.3 0.03	0 0.00	150 2.46		9.0 0.25			0.58				16	126	3	6		USGS
3/4 0910	5110	56	7.6	72	218	7.7	18 0.90	13 1.04	7.6 0.33	1.7 0.04	0 0.00	113 1.85		5.0 0.14			0.21				14	97	4	10		USGS
4/1 0825	1430	58	11.0	107	252	7.2	25 1.25	15 1.21	9.6 0.42	1.0 0.03	0 0.00	136 2.23		6.0 0.17			0.25				14	123	11	17		USGS
5/6 0910	980	65	8.9	94	254	6.9	25 1.25	13 1.05	8.9 0.39	1.0 0.03	0 0.00	140 2.29	12 0.25	6.0 0.17	0.4 0.01	0.1 0.01	0.29	19	Fe 0.01 Al 0.06[a] PO_4 0.15 Cu 0.02 Zn 0.03	155	14	115	0	2.4		USGS
6/3 1115	1060	74	8.0	93	256	7.3	26 1.30	13 1.10	8.9 0.39	1.0 0.03	0 0.00	144 2.36		6.0 0.17			0.32				14	120	2	3		USGS
7/8 0915	254	76	7.2	85	288	7.8			9.9 0.43		0 0.00	165 2.70		6.0 0.17			0.47				14	130	0	2		USGS
8/5 0810	146	76	7.3	86	291	7.8			10 0.44		0 0.00	164 2.69		6.2 0.17			0.51				14	137	3	1		USGS
9/10 0830	136	70	8.0	89	279	7.7	25 1.25	16 1.31	11 0.48	1.6 0.04	0 0.00	166 2.72	5.8 0.12	4.5 0.13	0.2 0.00	0.3 0.02	0.52	18	PO_4 0.00[a] Al 0.07	165	16	128	0	2		USGS
10/16 1400	2250				226	7.4			9.6 0.42		0 0.00	114 1.87		6.5 0.18			0.35				19	93	0	20		USGS
11/4 0900	716	57	7.8	75	272	7.3			10 0.44		0 0.00	148 2.43		7.5 0.21			0.41				15	120	0			USGS
12/16 0940	1470	53	1.4	14	251	7.4			12 0.52		0 0.00	121 1.98		11 0.31			0.51					103		20	Median 23 Max. 7,000 Min. 0.23	USGS

a Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and chromium (Cr), reported here as $\frac{0.0}{0.00}$ except as shown.

b Determined by addition of analyzed constituents

c Gravimetric determination.

d Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by Calif. Dept of Public Health, Division of Laboratories.

e Mineral analyses made by USGS, Quality of Water Branch (USGS), Pacific Chemical Consultant (PCC), Metropolitan Water District (MWD), Los Angeles Dept. of Water & Power (LADWP), City of Los Angeles Dept. of Pub Health (LADPH) Long Beach Dept. of Pub Health (LBDPH) or State Department of Water Resources (DWR), as indicated

f Field pH except when noted with e

ANALYSES OF SURFACE WATER

Date and time sampled PST	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity in ppm	Coliform[d] MPN/ml	Analyzed by[e]
						f	Mineral constituents in parts per million / equivalents per million																			
1956											RUSSIAN RIVER AT GUERNEVILLE															USGS
1/13 1430	9,500	50	10.8	95	141	7.5	---	---	5.8/0.25	---	0/0.00	76/1.25	---	4.0/0.11	---	---	0.04/---	--		---	17	60	0	200		
2/3 0850	22,500	50	10.6	94	129	7.2	---	---	5.0/0.22	---	0/0.00	68/1.11	---	3.5/0.10	---	---	0.18/---	--		---	16	56	0	335	Maximum 7000. Minimum 0.045 Median 6.2	
3/10 0820	4,010	50	11.6	102	239	7.2	---	---	8.2/0.36	---	0/0.00	138/2.26	---	5.5/0.16	---	---	0.08/---	--		---	14	114	1	30		
4/4 1325	29,500	56	10.0	95	139	7.6	---	---	5.9/0.26	---	0/0.00	74/1.31	---	4.5/0.13	---	---	0.10/---	--		---	18	58	0	300		
5/9 1430	940	65	9.6	102	293	8.4	28/1.40	17/1.38	9.8/0.43	1.7/0.04	0/0.00	166/2.72	13/0.27	6.8/0.19	0.5/0.01	0.0/0.00	0.16/---	19/--	Al 0.09 Cu 0.01 PO_4 0.30 a	178[b]	13	139	3	15		
6/6 1415	535	70	9.2	102	280	8.0	---	---	9.4/0.41	---	0/0.00	153/2.51	---	6.0/0.17	---	---	0.3/---	--		---	14	130	5	6		
7/11 1450	216	77	9.6	114	292	7.8	---	---	9.1/0.40	---	0/0.00	168/2.75	---	6.2/0.17	---	---	0.5/---	--		---	13	135	0	9		
8/8 1440	168	78	8.0	97	293	8.3	---	---	9.0/0.39	---	0/0.00	165/2.70	---	6.5/0.18	---	---	0.5/---	--		---	13	136	1	7		
9/12 1400	177	70	8.8	98	288	8.5	28/1.40	16/1.34	8.3/0.36	1.4/0.04	0/0.00	164/2.69	12/0.25	5.0/0.14	0.5/0.01	0.0/0.00	0.6/---	13/--	PO_4 0.00 a	166[b]	11	137	3	15		
10/7 1030	256	70	10.0	111	266	7.6	---	---	8.8/0.38	---	0/0.00	149/2.44	---	7.3/0.21	---	---	0.6/---	--		---	14	121	0	6		
11/10 0950	335	62	9.0	92	262	8.2	---	---	10/0.44	---	0/0.00	104/1.70	---	8.5/0.24	---	---	0.8/---	--		---	15	122	37	9		
12/5 1100	180	52	10.6	96	313	7.6	---	---	12/0.52	---	0/0.00	174/2.85	---	12/0.34	---	---	1.1/---	--		---	16	140	0	15		

a Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and hexavalent chromium (Cr^{+6}), reported as $\frac{0.0}{0.00}$ except as shown.
b Determined by addition of analyzed constituents.
c Gravimetric determination.
d Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by Calif. Dept. of Public Health, Division of Laboratories, or United States Public Health Service.
e Mineral analyses made by USGS, Quality of Water Branch (USGS), United States Public Health Service (USPHS), San Bernardino County Flood Control District (SBCFCD), Metropolitan Water District (MWD), Los Angeles Dept. of Water & Power (LADWP), City of Los Angeles Dept. of Pub. Health (LADPH), Long Beach Dept. of Pub. Health (LBOPH), Terminal Testing Laboratories, Inc. (TTL) State Department of Water Resources (DWR), as indicated.

ANALYSES OF SURFACE WATER

NORTH COASTAL REGION (NO. 1)

RUSSIAN RIVER AT GUERNEVILLE

Mineral constituents in parts per million / equivalents per million

Date and time sampled P.S.T.	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH[a]	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity in ppm	Coliform[h] MPN/ml	Analyzed by[i]
1959																									Median 6.2	USGS
1/22 1430	1,100	52	10.1	91	269	7.3	2.50[c]		9.0 / 0.39		0.0 / 0.00	136 / 2.23		8.8 / 0.25			0.4			155[e]	13	125	13	60	Maximum 620.	
2/5 1740	1,020	52	11.3	102	260	7.3	2.28[c]		9.0 / 0.39		0.0 / 0.00	129 / 2.11		8.0 / 0.23			0.4			156[e]	15	114	8	2	Minimum 0.045	
3/2 1500	2,030	59	9.0	89	261	7.1	2.24[c]		9.1 / 0.40		0.0 / 0.00	132 / 2.16		7.5 / 0.21			0.4			161[e]	15	112	4	60		
4/1 1410	1,220	63	8.9	92	214	7.3	1.90[c]		7.9 / 0.34		0.0 / 0.00	111 / 1.82		6.2 / 0.17			0.2			127[e]	15	95	4	40		
5/4 0915	295	70	8.2	91	289	7.2	30 / 1.50	14 / 1.16	10 / 0.44	1.0 / 0.03	0.0 / 0.00	161 / 2.64	13 / 0.27	7.4 / 0.21	0.4 / 0.01	0.0 / 0.00	0.4	16	Fe 0.01 Al 0.06 PO_4 0.15 [d]	171[f]	14	133	1	4		
6/1 0935	142	70	8.3	92	301	7.3	2.94[c]		9.6 / 0.42		0.0 / 0.00	177 / 2.90		6.5 / 0.18			0.4			178[e]	12	147	2	4		
7/13 0930	156	78	7.7	93	267	7.7	2.48[c]		9.4 / 0.41		0.0 / 0.00	155 / 2.54		5.0 / 0.14			0.4			158[e]	14	124	0	3		
8/3 0825	165	75	7.8	91	263	7.6	2.48[c]		8.5 / 0.37		0.0 / 0.00	154 / 2.52		5.5 / 0.16			0.4			156[e]	13	124	0	30		
9/7 0930	189	76	6.8	80	254	7.4	26 / 1.30	13 / 1.10	9.4 / 0.41	1.5 / 0.04	0.0 / 0.00	147 / 2.41	9.0 / 0.19	5.2 / 0.15	0.4 / 0.01	0.1 / 0.01	0.4	14	Al 0.12 PO_4 0.10 [d]	151[f]	14	120	0	12		
10/5 1100	207	66	8.3	88	285	7.5	2.64[c]		10 / 0.44		0.0 / 0.00	165 / 2.70		7.0 / 0.20			0.5			169[e]	14	132	0	6		
11/2 1025	245	57	9.6	92	238	7.5	2.17[c]		8.1 / 0.35		0.0 / 0.00	137 / 2.25		5.1 / 0.14			0.4			141[e]	14	108	0	4		
12/8 1100	285	48	10.3	88	256	7.4	2.36[c]		9.6 / 0.42		0.0 / 0.00	144 / 2.36		10 / 0.28			0.3			152[e]	15	118	0	10		

a Field pH.

b Laboratory pH.

c Sum of calcium and magnesium in epm.

d Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and hexavalent chromium (Cr^{+6}), reported here as $\frac{0.0}{0.00}$ except as shown.

e Derived from conductivity vs TDS curves.

f Determined by addition of analyzed constituents.

g Gravimetric determination.

h Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by California Department of Public Health, Division of Laboratories, or United States Public Health Service

i Mineral analyses made by United States Geological Survey, Quality of Water Branch (USGS); United States Department of the Interior, Bureau of Reclamation (USBR); United States Public Health Service (USPHS);; San Bernardino County Flood Control District (SBCFCD); Metropolitan Water District of Southern California (MWD); Los Angeles Department of Water and Power (LADWP); City of Los Angeles, Department of Public Health (LADPH); City of Long Beach, Department of Public Health (LBDPH); Terminal Testing Laboratories, Inc. (TTL); or California Department of Water Resources (DWR); as indicated.

ANALYSES OF SURFACE WATER

NORTH COASTAL REGION (NO. 1)

RUSSIAN RIVER AT GUERNEVILLE

Date and time sampled P S T	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH[a]	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity in ppm	Coliform[h] MPN/ml	Analyzed by[i]
1960																										USGS
1/11 1025	413	50	9.8	87	268	7.4	2.26[c]		15 / 0.65		0.0 / 0.00	132 / 2.16		13 / 0.37			0.4			159[e]	22	113	5	30	Median 23.	
2/8 0940	50,400	55	9.1	86	85.8	7.2	0.80[c]		2.9 / 0.13		0.0 / 0.00	41 / 0.67		5.0 / 0.14			0.0			51[e]	14	40	6	2,800	Maximum 7,000.	
3/7 0950	16,300	55	9.5	89	139	7.3	1.16[c]		4.9 / 0.21		0.0 / 0.00	64 / 1.05		6.2 / 0.17			0.1			83[e]	15	58	6	700	Minimum 0.62	
4/4 0945	1,690	63	8.6	89	228	7.5	2.14[c]		7.1 / 0.31		0.0 / 0.00	124 / 2.03		7.5 / 0.21			0.3			136[e]	13	107	5	50		
5/9 1320	648	70	7.9	88	253	7.1	23 / 1.15	14 / 1.17	8.7 / 0.38	1.5 / 0.04	0.0 / 0.00	144 / 2.36	13 / 0.27	6.2 / 0.17	1.0 / 0.02	0.0 / 0.00	0.4	16	Fe 0.02 Al 0.06 PO_4 0.15[d] Cu 0.01	155[f]	14	116	0	5		
6/6 0900	383	71	7.6	86	259	7.5	2.38[c]		8.4 / 0.37		0.0 / 0.00	150 / 2.46		8.0 / 0.23			0.4			154[e]	13	119	0	1		
7/11 0935	205	72	8.1	92	264	7.9	2.44[c]		6.8 / 0.30		6 / 0.20	144 / 2.36		5.5 / 0.16			0.3			157[e]	11	122	0	8		
8/1 0915	175 (est.)	72	8.0	91	262	7.5	2.32[c]		8.9 / 0.39		0.0 / 0.00	146 / 2.39		6.0 / 0.17			0.4			156[e]	14	[illegible]		[illegible]		
9/15 0800	170	70	8.1	90	263	7.5	24 / 1.20	15 / 1.22	10 / 0.44	1.1 / 0.03	0.0 / 0.00	153 / 2.51	11 / 0.23	5.0 / 0.14	0.0 / 0.00	0.0 / 0.00	0.4	18	Al 0.02 PO_4 0.05[d]	160[f]	1	121	0	[illegible]		
10/13 0925	222	61	9.6	97	257	7.7	24 / 1.20	13 / 1.08	9.7 / 0.42		0.0 / 0.00	140 / 2.29		8.0 / 0.23			0.4			[illegible][e]	[illegible]	114	0	1		
11/4 0810	255	58	9.1	89	244	7.3	2.16[c]		8.9 / 0.39		2 / 0.07	127 / 2.08		5.5 / 0.16			0.4			[illegible][e]	[illegible]	[illegible]	1	3		
12/8 0855	1,110	47	10.1	86	264	7.3	2.28[c]		9.3 / 0.40		0.0 / 0.00	65 / 1.07		7.2 / 0.20			0.4			[illegible][e]	[illegible]	114	61	18		

Mineral constituents in parts per million / equivalents per million.

a Field pH.

b Laboratory pH.

c Sum of calcium and magnesium in epm.

d Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and hexavalent chromium (Cr^{+6}), reported here as $\frac{0.0}{0.00}$ except as shown.

e Derived from conductivity vs TDS curves.

f Determined by addition of analyzed constituents.

g Gravimetric determination.

h Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by California Department of Public Health, Division of Laboratories, or United States Public Health Service.

i Mineral analyses made by United States Geological Survey, Quality of Water Branch (USGS); United States Department of the Interior, Bureau of Reclamation (USBR); United States Public Health Service (USPHS); San Bernardino County Flood Control District (SBCFCD); Metropolitan Water District of Southern California (MWD); Los Angeles Department of Water and Power (LADWP), City of Los Angeles, Department of Public Health (LADPH); City of Long Beach, Department of Public Health (LBDPH); Terminal Testing Laboratories, Inc. (TTL); or California Department of Water Resources (DWR); as indicated.

ANALYSES OF SURFACE WATER

NORTH COASTAL REGION (1)

RUSSIAN RIVER AT GUERNEVILLE

Date and time sampled P.S.T.	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH[a]	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity in ppm	Coliform[h] MPN/ml	Analyzed by[i]
							Mineral constituents in parts per million / equivalents per million																			
1961																										USGS
1/4 1630	792	46	11.2	94	266	7.4	2.46[c]		9.3 / 0.40		0.0 / 0.00	143 / 2.34		6.0 / 0.17			0.3			158[e]	14	123	66	4	Median 13.	
2/17 1205	5,380	52	10.3	93	193	7.3	1.62[c]		6.5 / 0.28		0.0 / 0.00	96 / 1.57		4.0 / 0.11			0.1			115[e]	15	81	2	40	Maximum 7,000.	
3/1 1315	1,530	57	9.8	94	280	7.3	2.54[c]		13 / 0.57		0.0 / 0.00	146 / 2.39		5.5 / 0.16			0.3			166[e]	18	127	7	20	Minimum 0.62	
4/13 0830	1,450	60	9.5	95	258	7.7	2.40[c]		9.3 / 0.40		0.0 / 0.00	139 / 2.28		6.0 / 0.17			0.3			154[e]	14	120	6	13		
5/4 0800	770	60	10.6	106	253	7.9	24 / 1.20	13 / 1.04	13 / 0.57	2.5 / 0.06	0.0 / 0.00	139 / 2.28	14 / 0.29	5.8 / 0.16	1.1 / 0.02	0.1 / 0.01	0.1	13	Fe 0.02 Al 0.03[d] PO_4 0.10	155[f]	20	112	0	6		
6/1 1110	449	67	8.2	88	264	7.8	2.38[c]		9.3 / 0.40		0.0 / 0.00	144 / 2.36		6.5 / 0.18			0.3			157[e]	14	119	1	4		
7/7 1300	289	76	8.6	102	242	8.0	2.23[c]		7.7 / 0.33		0.0 / 0.00	136 / 2.23		3.1 / 0.09			0.3			144[e]	13	112	0	13		
8/1 0920	286	73	8.2	94	236	7.9	2.30[c]		7.5 / 0.33		0.0 / 0.00	133 / 2.18		4.0 / 0.11			0.3			140e	13	115	6	2		
9/5 0815	381	72	8.6	98	226	8.1	23 / 1.15	11 / 0.93	7.9 / 0.34	1.1 / 0.03	0.0 / 0.00	128 / 2.10	8.0 / 0.17	2.5 / 0.07	0.7 / 0.01	0.1 / 0.01	0.4	14	Fe 0.08 PO_4 0.05[d] Zn 0.03	132[f]	14	104	0	5		
10/2 0955	349	69	9.7	107	233	7.5	2.16[c]		8.1 / 0.35		0.0 / 0.00	130 / 2.13		5.8 / 0.16			0.3			139[e]	14	108	1	5		
11/9 0850	213	54	10.4	97	250	8.0	2.24[c]		9.3 / 0.40		0.0 / 0.00	141 / 2.31		5.2 / 0.15			0.3			149[e]	15	112	0	3		
12/11 1445	640	50	9.2	81	281	7.3	2.49[c]		10 / 0.44		0.0 / 0.00	140 / 2.29		8.0 / 0.23			0.4			167[e]	15	125	10	10		

a Field pH.

b Laboratory pH.

c Sum of calcium and magnesium in epm.

d Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and hexavalent chromium (Cr^{+6}), reported here as $\frac{0.0}{0.00}$ except as shown.

e Derived from conductivity vs TDS curves.

f Determined by addition of analyzed constituents.

g Gravimetric determination.

h Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by California Department of Public Health, Division of Laboratories, or United States Public Health Service.

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ANALYSES OF SURFACE WATER

NORTH COASTAL REGION (1)

RUSSIAN RIVER AT GUERNEVILLE

Date and time sampled P.S.T.	Discharge in cfs	Temp in °F	Dissolved oxygen (e = 1.00) ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH [a]	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity in ppm	Coliform[h] MPN/ml	Analyzed by [i]
							Mineral constituents in parts per million / equivalents per million																			
1962																										
1/8 1420	385	53	10.2	94	295	7.5	2.66[c]		11 / 0.48		0 / 0.00	149 / 2.44		9.9 / 0.28			0.4			176[e]	15	133	11	2	Median 9.6	USGS
2/13 1550	51,300	53	9.9	91	82	7.1	0.68[c]		3.5 / 0.15		0 / 0.00	38 / 0.62	2.0 / 0.04	2.8 / 0.08	1.7 / 0.03		0.0			49[e]	18	34	3	1,000	Max. >7000.	
3/6 1345	30,300	49	10.3	90	102	7.7	0.92[c]		4.0 / 0.17		0 / 0.00	51 / 0.84		2.8 / 0.08			0.1			61[e]	16	46	4	180	Min. 1.3	
4/10 1410	529	50	10.0	88	292	8.1	2.62[c]		12 / 0.52		0 / 0.00	157 / 2.57		9.0 / 0.25			0.2			174[e]	17	131	2	2		
5/8 1258	373	65	12.2	128	304	8.0	28 / 1.40	17 / 1.36	11 / 0.48	1.6 / 0.04	0 / 0.00	162 / 2.66	16 / 0.33	6.2 / 0.17	2.4 / 0.04	0.0 / 0.00	0.3	17	PO_4 0.35	180[f]	15	138	5	8		
6/5 1217	170	70	10.6	118	305	7.6	2.84[c]		10 / 0.44		0 / 0.00	166 / 2.72		6.2 / 0.17			0.2			181[e]	13	142	6	5		
7/9 1103	123	74	12.0	139	297	8.0	2.74[c]		10 / 0.44		0 / 0.00	164 / 2.69		6.2 / 0.17			0.4			176[e]	14	137	3	20		
8/7 1350	156	70	8.7	97	272	8.1	2.44[c]		9.3 / 0.40		0 / 0.00	156 / 2.56		5.4 / 0.15			0.3			162[e]	14	122	0	10		
9/11 1350	164	71	11.6	131	260	7.2	26 / 1.30	14 / 1.16	8.6 / 0.37	1.0 / 0.03	0 / 0.00	153 / 2.51	10 / 0.21	5.0 / 0.14	0.3 / 0.00	0.1 / 0.01	0.3	15	PO_4 0.30	143[g]	13	123	0	6		

a Field pH

b Laboratory pH

c Sum of calcium and magnesium in epm.

d Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and hexavalent chromium (Cr^{+6}), reported here as $\frac{0.0}{0.00}$ except as shown.

e Derived from conductivity vs TDS curves f = 0.595

f Determined by addition of analyzed constituents.

g Gravimetric determination

h Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by California Department of Public Health, Division of Laboratories, or United States Public Health Service.

i Mineral analyses made by United States Geological Survey, Quality of Water Branch (USGS); United States Department of the Interior, Bureau of Reclamation (USBR); United States Public Health Service (USPHS); San Bernardino County Flood Control District (SBCFCD); Metropolitan Water District of Southern California (MWD), Los Angeles Department of Water and Power (LADWP); City of Los Angeles, Department of Public Health (LADPH); City of Long Beach, Department of Public Health (LBDPH), Terminal Testing Laboratories, Inc. (TTL); or California Department of Water Resources (DWR); as indicated.

ANALYSES OF SURFACE WATER

NORTH COASTAL REGION (NO. 1)

Date and time sampled P.S.T.	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH a/b	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity in ppm	Coliform MPN/ml	Analyzed by i
							Mineral constituents in parts per million / equivalents per million																			
											RUSSIAN RIVER AT GUERNEVILLE															
10-8-62 1700	188	68	10.0	109	265	7.9 / 8.3		2.41^{c}	10 / 0.44		3 / 0.10	150 / 2.46		9.0 / 0.25			0.3			157^{e}	15	120	0	8	2.1 / 6.2	USGS
11-13-62 1230	481	64	10.6	110	269	7.7 / 8.0		2.36^{c}	9.8 / 0.43		0 / 0.00	141 / 2.31		7.2 / 0.20			0.5			159^{e}	15	118	2	3	23. / 2.3	
12-10-62 1210	730	54	9.4	87	258	7.3 / 8.1		2.31^{c}	9.3 / 0.40		0 / 0.00	144 / 2.36		6.2 / 0.17			0.3			153^{e}	15	116	0	20	2.3 / 2.3	
1-2-63 1335	690	52	10.0	90	291	7.4 / 8.0		2.62^{c}	11 / 0.48		0 / 0.00	160 / 2.62		9.7 / 0.27			0.2			172^{e}	15	131	0	20	62. / 23	
2-11-63 1425	7,310	60	9.4	94	200	7.3 / 7.6		1.72^{c}	7.8 / 0.34		0 / 0.00	108 / 1.77		4.8 / 0.14			0.1			118^{e}	17	86	0	70	7,000 / 1,300	
3-11-63 1345	945	60	11.5	115	284	7.8 / 8.0		2.57^{c}	9.8 / 0.43		0 / 0.00	156 / 2.56		7.0 / 0.20			0.3			168^{e}	14	129	1	9	23. / 23	
4-9-63 1615	11,700	56	9.9	94	174	8.0 / 7.7		1.46^{c}	5.5 / 0.24		0 / 0.00	86 / 1.41		3.5 / 0.10			0.0			103^{e}	14	73	2	95	130 / 620	
5-6-63 1250	2,130	63	9.9	102	245	7.4 / 8.1	23 / 1.15	13 / 1.09	8.0 / 0.35	1.2 / 0.03	0 / 0.00	137 / 2.25	13 / 0.27	4.2 / 0.12	1.9 / 0.03	0.3 / 0.02	0.1	17	PO_4 = 0.20 As = 0.00 ABS = 0.00	146^{g}	13	112	0	30	13. / 5.2	
6-13-63 1230	440	70	9.8	109	302	7. / 8.4		2.76^{c}	9.5 / 0.41		7 / 0.23	160 / 2.62		6.8 / 0.19			0.4			179^{e}	13	138	0	5	6 2 / 13.	
7-11-63 1600	216	77	10.2	122	310	8.2 / 8.1		2.96^{c}	11 / 0.48		0 / 0.00	178 / 2.92		6.0 / 0.17			0.4			184^{e}	14	148	2	30	2 3 / 130	
8-7-63 2100	142	71	10.1	114	304	7. / 8.1		2.85^{c}	8.9 / 0.39		0 / 0.00	174 / 2.85		7.4 / 0.21			0.1			180^{e}	12	143	0	4	2.3 / 6 2	
9-13-63 1515	216	72	8.1	92	275	7.6 / 8.4	27 / 1.35	14 / 1.17	9.3 / 0.40	1.2 / 0.03	5 / 0.17	150 / 2.46	11 / 0.23	4.8 / 0.14	0.8 / 0.01	0.2 / 0.01	0.3	16	As = 0.00 ABS = 0.0 PO_4 = 0.10	163^{g}	14	126	0	30	2 3 / 6.2	

a Field pH

b Laboratory pH

c Sum of calcium and magnesium in epm.

d Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and hexavalent chromium (Cr^{+6}), reported here as $\frac{0.0}{0.00}$ except as shown.

e Derived from conductivity vs TDS curves.

f Determined by addition of analyzed constituents.

g Gravimetric determination.

h Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by California Department of Public Health, Division of Laboratories, or United States Public Health Service.

i Mineral analyses made by United States Geological Survey, Quality of Water Branch (USGS); United States Department of the Interior, Bureau of Reclamation (USBR); United States Public Health Service (USPHS), San Bernardino County Flood Control District (SBCFCD); Metropolitan Water District of Southern California (MWD); Los Angeles Department of Water and Power (LADWP); City of Los Angeles, Department of Public Health (LADPH); City of Long Beach, Department of Public Health (LBDPH); Terminal Testing Laboratories, Inc. (TTL); or California Department of Water Resources (DWR); as indicated.

ANALYSES OF SURFACE WATER

NORTH COASTAL REGION (NO. 1)

Date and time sampled P.S.T.	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH a/b	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity in ppm	Coliform[h] MPN/ml	Analyzed by[i]
							Mineral constituents in parts per million / equivalents per million																			
											RUSSIAN RIVER AT GUERNEVILLE															
10-9-63 1655	216	69	8.4	92	276	7.7 / 7.9		/ 2.48[c]	9.4 / 0.41		0 / 0.00	155 / 2.54		9.0 / 0.25			0.2				14	124	0	5	2.3 / 6.2	USGS
11-14-63 2145	4,710	57	9.1	88	189	7.5 / 7.5		/ 1.60[c]	7.1 / 0.31		0 / 0.00	89 / 1.46		5.2 / 0.15			0.3				16	80	7	40	2,400. / 2,400.	
12-11-63 1545	375	49	10.7	93	306	7.4 / 7.8		/ 2.72[c]	11 / 0.48		0 / 0.00	159 / 2.61		9.0 / 0.25			0.3				15	136	6	3	6.2 / 6.2	
1-10-64 1355	748	48	11.5	99	228	7.1 / 8.5		/ 2.02[c]	9.3 / 0.40		7 / 0.23	121 / 1.98		7.1 / 0.20			0.3				17	101	0	15	23. / 6.2	
2-5-64 1500	1,570	54	10.4	97	264	7.5 / 7.8		/ 2.40[c]	9.8 / 0.43		0 / 0.00	144 / 2.36		7.8 / 0.22			0.2				15	120	2	6	2.3 / 62.	
3-13-64 1400	1,620	52	10.6	96	218	8.4 / 7.8		/ 1.92[c]	8.7 / 0.38		0 / 0.00	109 / 1.79		5.2 / 0.15			0.2				17	97	8	25	620. / 62.	
4-17-64 1550	340	67	11.5	124	312	8.3 / 8.4		/ 2.85[c]	12 / 0.52		3 / 0.10	166 / 2.72		9.0 / 0.25			0.3				15	142	1	4	.62 / 2.3	
5-14-64 1310	173	70	11.4	127	329	8.2 / 8.1	29 / 1.45	19 / 1.53	12 / 0.52	1.7 / 0.04	0 / 0.00	182 / 2.98	17 / 0.35	9.0 / 0.25	0.7 / 0.01	0.1 / 0.01	0.4	14	As = 0.00 ABS = 0.1 PO_4 = 0.45	186	15	149	0	1	23. / 23.	
6-5-64 1415	114	73	9.1	104	339	8.4 / 8.0		/ 3.12[c]	12 / 0.52		0 / 0.00	189 / 3.10		8.5 / 0.24			0.5				14	156	1	1	13. / 23.	
7-16-64 1700	152	77	10.2	122	281	8.2 / 7.9		/ 2.64[c]	8.8 / 0.38		0 / 0.00	157 / 2.57		5.0 / 0.14			0.4				13	132	3	5	23. / 13.	
8-13-64 1245	142	76	8.5	100	273	8.1 / 8.3		/ 2.54[c]	9.5 / 0.41		1 / 0.03	152 / 2.49		4.5 / 0.13			0.6				14	127	1	9	23. / 6.2	
9-4-64	170	74	9.0	104	269	8.0 / 8.0	27 / 1.35	14 / 1.13	9.0 / 0.39	1.0 / 0.03	0 / 0.00	154 / 2.52	11 / 0.23	4.6 / 0.13	0.9 / 0.01		0.5	16	As = 0.00 ABS = 0.0 PO_4 = 0.00	143	13	124	0	2	.62 / 1.3	

a Field pH.

b Laboratory pH.

c Sum of calcium and magnesium in epm.

d Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and hexavalent chromium (Cr^{+6}), reported here as $\frac{0.0}{0.00}$ except as shown.

e Derived from conductivity vs TDS curves

f Determined by addition of analyzed constituents.

g Gravimetric determination.

h Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by California Department of Public Health, Division of Laboratories, or United States Public Health Service.

i Mineral analyses made by United States Geological Survey, Quality of Water Branch (USGS); United States Department of the Interior, Bureau of Reclamation (USBR); United States Public Health Service (USPHS), San Bernardino County Flood Control District (SBCFCD); Metropolitan Water District of Southern California (MWD); Los Angeles Department of Water and Power (LADWP), City of Los Angeles, Department of Public Health (LADPH); City of Long Beach, Department of Public Health (LBDPH); Terminal Testing Laboratories, Inc. (TTL); or California Department of Water Resources (DWR); as indicated

ANALYSES OF SURFACE WATER

Date and time sampled P.S.T.	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH a / b	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity a / b	Coliform[c] MPN/ml	Analyzed by[d]
							Mineral constituents in parts per million / equivalents per million																			
NORTH COASTAL REGION (NO. 1)																										
RUSSIAN RIVER AT GUERNEVILLE																										
10-14-64 1530	177	69	10.6	117	292	8.2 / 8.4		2.54[e]	11 / 0.48		4 / 0.13	154 / 2.52		7.4 / 0.21			0.4				16	127	0	1	2.3 / 23.	USGS
11-11-64 1330	5,660	53	8.9	81	170	7.4 / 7.4		1.36[e]	7.2 / 0.31		0 / 0.00	69 / 1.13		6.4 / 0.18			0.2				19	68	11	280	7,000. / 7,000.	
12-2-64 1515	2,050	56	9.6	91	220	7.6 / 8.2		1.80[e]	8.6 / 0.37		0 / 0.00	105 / 1.72		5.2 / 0.15			0.3				17	90	4	70	230. / 230.	
1-7-65 1510	39,100	50	10.0	88	121	7.2 / 7.5		1.00[e]	5.9 / 0.26		0 / 0.00	58 / 0.95		3.4 / 0.10			0.2				21	50	2	500	21. / 230.	
2-5-65 1310	4,030	49	9.9	86	217	7.6 / 7.7		1.86[e]	8.1 / 0.35		0 / 0.00	106 / 1.74		5.9 / 0.17			0.2				16	93	6	20	620. / 2,400.	

a Field determination.

b Laboratory analysis.

c Analyzed by California Department of Public Health, Division of Laboratories.

d Mineral analyses made by United States Geological Survey, Water Resources Division (USGS) or California Department of Water Resources (DWR) as indicated.

e Sum of calcium and magnesium in epm.

ANALYSES OF SURFACE WATER

Date and time sampled P.S.T.	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH a/b	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity a/b	Coliform[c] MPN/ml	Analyzed by[d]
							Mineral constituents in parts per million / equivalents per million																			
NORTH COASTAL REGION (NO. 1)																										
RUSSIAN RIVER AT GUERNEVILLE (STA. 10) (Cont.)																										
3-10-65 1450	816	55	9.2	86	290	7.4/8.2		—/2.66[e]	10/0.44		0/0.00	155/2.54		7.9/0.22			0.3				14	133	6	—/15	23. / 230.	USGS
4-16-65 1530	14,500	56	10.2	97	129	7.4/7.1		—/1.14[e]	5.2/0.23		0/0.00	64/1.05		2.8/0.08			0.1				17	57	5	—/650	62. / 230.	
5-12-65 1210	880	69	10.2	112	269	8.0/8.6	26/1.30	14/1.14	9.4/0.41	1.1/0.03	4/0.13	136/2.23	14/0.29	5.9/0.17	3.5/0.06		0.3	15	As = 0.00 ABS = 0.0 PO_4 = 0.15	150	14	122	4	—/20	23. / 23.	
6-4-65 1520	417	65	7.1	75	279	7.8/8.5		—/2.60[e]	9.6/0.42		4/0.13	144/2.36		6.0/0.17			0.4				14	130	5	—/15	2.3 / 23.	

a Field determination.

b Laboratory analysis.

c Analyzed by California Department of Public Health, Division of Laboratories.

d Mineral analyses made by United States Geological Survey, Water Resources Division (USGS) or California Department of Water Resources (DWR) as indicated.

e Sum of calcium and magnesium in epm.

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

GREEN VALLEY CREEK (STATION 4)
7N/9W - 6N

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents[b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hach / Hellige	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																		
7-6-65 1040	< 2	61	4.5	45.5	290	6.9 / 8.1	20 / 1.00	13 / 1.10	15 / 0.65	2.9 / 0.07	0 / 0.00	131 / 2.15	12 / 0.25	15 / 0.42	0.7 / 0.01	0.1 / 0.00	0.1		PO_4 = 0.41 Color = 20 Fe = 1.5	156	23	105	0	12	DWR
9-29-65 1150	0	63.5	2.8	29.1	355	7.3 / 8.4	2.84[c]				5 / 0.17	162 / 2.66		14 / 0.39	1.5 / 0.02				PO_4 = 1.3			142	1	90	DWR
12-17-65 1210	1.5	43.5	3.9	31.5	370	6.9 / 7.9	2.44[c]				0 / 0.00	135 / 2.21		30 / 0.85	0.8 / 0.01				PO_4 = 1.5			122	11	35	DWR
1-20-66 1235	2	47	10.0	84.9	285	7.1 / 7.8	2.30[c]				0 / 0.00	96 / 1.57		19 / 0.54	4.2 / 0.07				PO_4 = 0.43			115	36	11	DWR
3-3-66 0900	4	45	10.7	88.4	235	7.1 / 8.3	27	13			0 / 0.00	92 / 1.51		15 / 0.42	2.6 / 0.04		0.1			154		122	47	27	DWR
4-14-66 1330	4	60	8.2	81.9	280	7.1	2.10[c]					128		18 / 0.51	1.8 / 0.03				PO_4 = 0.96 (Ortho)			105		8.6	DWR
5-9-66 0855	1.5	58	7.2	70.3	270	7.1						134		17 / 0.48	1.9 / 0.03				PO_4 = 0.67 (Ortho)					< 5 / 3.5	DWR
6-6-66 1455	1	59	7.0	69.0	285	7.1	1.88[c]					140		16 / 0.45	1.2 / 0.02				PO_4 = 0.57 (Ortho) Fe = 0.12			94			DWR
7-18-66 0930	0	62	0.1	1.0	370	7.2						177		14 / 0.39	1.0 / 0.02				PO_4 = 0.50 (Ortho) Mn = 0.84 Fe = 1.1					40 / 6.3	DWR
8-18-66 0820	Dry																								

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hach turbidity in Jackson Turbidity Units using Hach Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

MARK WEST CREEK AT TRENTON-HEALDSBURG ROAD (STATION 5)
8N/9W - 34M

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents[b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hach / Hellige	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																		
7-6-65 1020	3	70	4.4	49.1	740	7.7	41 / 2.04	27 / 2.26	75 / 3.26	8.4 / 0.21	0 / 0.00	294 / 4.82	30 / 0.02	63 / 1.78	12 / 0.19	0.6 / 0.03	0.6		PO_4 = 12 ABS = 1.2 Fe = 1.6 Color = 25	417	42	215	0	30	DWR
7-6-65 1600		78.5	5.5	66.4	600																				Field Determination
7-9-65 0415		68	4.1	44.8	790	7.6																			Field Determination
9-30-65 0330		60	7.8	77.9	960	7.8																			Field Determination
9-30-65 1150		70.5	14.75	166	910	8.9 / 8.3	4.32[c]				0 / 0.00	244 / 4.00		104 / 2.93	56 / 0.90				PO_4 = 26 Fe = 5.6			216	16	170	DWR
10-27-65 1440	5	73	21.5	248	840	8.8					36 / 0.60	287 / 4.70												68	Field Determination
10-28-65 0400		62	9.5	97.1	860	9.4																			Field Determination
12-16-65 1625		45	9.7	80.1	575	7.5 / 7.6	3.36[c]				0 / 0.00	180 / 2.95		44 / 1.24	0.9 / 0.01				PO_4 = 3.5			168	20	30	DWR
12-17-65 0430		39.5	7.9	60.3	610	7.8																			Field Determination
1-20-66 1310	40	47	9.6	81.5	408	7.9 / 7.9	2.92[c]				0 / 0.00	154 / 2.52		24 / 0.68	11 / 0.18				PO_4 = 3.1			146	20	38	DWR
1-21-66 0410		43	9.0	72.3	360	7.3																			Field Determination
3-3-66 1420	30	49	10.3	89.7	310	7.5 / 8.3	23 / 1.15	14 / 1.15			0 / 0.00	131 / 2.15		20 / 0.56	7.5 / 0.12		0.1			188		110	3	42	DWR

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hach turbidity in Jackson Turbidity Units using Hach Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

MARK WEST CREEK AT TRENTON-HEALDSBURG ROAD (STATION 5)
8N/9W - 34M

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents[b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity[d] in ppm Hach / Hellige	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																		
3-4-66 0300		48	9.[illegible]	82.7	300	7.3																			Field Determination
4-14-66 1610	30	66	11.8	126	400	8.3	2.90[c]					195		28 / 0.79	13 / 0.21		0.1		PO_4 = 4.5 (Ortho) ABS = 0.1			145		33	DWR
4-15-66 0355		66	5.4	57.7	430	7.[illegible]																			Field Determination
5-11-66 1600	25	72	9.5	108	530	8.1						268		41 / 1.16	20 / 0.32		0.3		PO_4 = 8.6 (Ortho) ABS = 0.1					65 / 33	DWR
5-12-66 0410		64	5.9	61.7	530	7.6																			Field Determination
6-9-66 1545	25	72	8.5	96.8	340	8.1 / 7.8	3.02[c]				0 / 0.00	271 / 4.44		61 / 1.72	14 / 0.22				PO_4 = 12.0 (Ortho) Fe = 1.2 ABS = 0.1			181	0	18.5 / 25	DWR
6-10-66 0220	25	68	10.0	109	700	8.7																			Field Determination
7-21-66 1500	15	83	7.5	93.0	310	8.1 / 8.3	4.82[c]		89 / 3.87	9.8 / 0.23	0 / 0.00	322 / 5.28		86 / 2.43	22 / 0.35		0.6		Fe = 1.5 Mn = 0.70 ABS = 0.2			241	0	14 / 21	DWR
8-19-66 0920	15	69	6.6	72.9	860	7.9						384		98 / 2.76	33 / 0.53				PO_4 = 22 (Ortho) Fe = 2.3 ABS = 0.1 Mn = 0.01	524				7 / 24	Field Determination

a Sum of calcium and magnesium in epm
b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)
c Gravimetric determination
d Hach turbidity in Jackson Turbidity Units using Hach Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter
e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

SANTA ROSA CREEK AT WILLOWSIDE ROAD (STATION)
7N/9W - 24B

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents [b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity[d] in ppm Hach / Hellige	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																		
7-6-65 0925	4	69	8.0	88.3	852	8.0 / 7.1	33 / 1.65	32 / 2.65	77 / 3.35	9.5 / 0.24	0 / 0.00	328 / 5.38	28 / 0.58	71 / 2.00	2.9 / 0.05		0.5		PO_4 = 17 ABS = 1.8 Color = 65 Fe = 6.8	465	42	215	0	110	DWR
7-9-65 0335	5	70	2.35	26.2	850	7.5																			Field Determination
9-30-65 0245	10	62	2.2	22.5	1130	7.5																			Field Determination
9-30-65 1120	8	70	5.8	64.7	1000	7.6 / 8.2	4.24[a]				0 / 0.00	230 / 3.77		105 / 2.96	64 / 1.03		0.6		PO_4 = 30 Fe = 1.1			212	23	60	DWR
10-27-65 1335	4	77	29.3	351	835	8.9					42 / 0.7	293 / 4.80												94	Field Determination
10-28-65 0330		62	4.6	47	900	9.2																			Field Determination
12-17-65 0350		40	9.0	69.2		8.0																			Field Determination
12-17-65 1300	7	50	17.8	157	845	8.5 / 8.2	4.60[a]				0 / 0.00	368 / 6.03		64 / 1.80	1.1 / 0.02				PO_4 = 13 Fe = 0.66			230	0	180	DWR
1-20-66 1425	25	55	12.3	116	508	8.3 / 7.9	3.72[a]				0 / 0.00	199 / 3.26		28 / 0.79	19 / 0.31				PO_4 = 3.8			186	23	12	DWR
1-21-66 0330		41	11.0	85.9	490	8.6																			Field Determination
3-3-66 1330	20	58	15.7	153	425	8.6 / 8.6	39	10			8 / 0.27	157 / 2.57		27 / 0.76	16 / 0.26		0.1			254		140	11		DWR
3-4-66 0215		44	9.2	74.9		7.5																			Field Determination

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hach turbidity in Jackson Turbidity Units using Hach Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

SANTA ROSA CREEK AT WILLOWSIDE ROAD (STATION 6)
7N/9W - 24B

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents [b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hach / Hellige	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																		
4-14-66 1650	12	78	20.3	263	480	8.3	1.78[c]					232		38 / 1.07	23 / 0.37		0.2		PO_4 = 6.6 (Ortho) ABS = 0.2			89		45	DWR
4-15-66 0315	12	58	4.2	41.0	580	7.8																			Field Determination
5-11-66 1640	15	83	19.0	242	600	8.9						299		57 / 1.61	34 / 0.55		0.3		PO_4 = 12.0 (Ortho) ABS = 0.2					100 / 52	DWR
5-12-66 0320	18	59	1.8	17.8	600	7.8																			Field Determination
6-9-66 1610	12	87	10.3	138	720	8.9 / 8.1	3.54[c]				0 / 0.00	252 / 4.13		73 / 2.06	26 / 0.42				PO_4 = 10.0 (Ortho) ABS = 0.3			177	0	40 / 13	DWR
6-10-66 0130	15	64	1.1	11.5	920	7.9																			Field Determination
7-21-66 1430	8	95	13.7	194	740	8.9 / 8.3	4.10[c]		86 / 3.74	8.8 / 0.21	0 / 0.00	260 / 4.26		80 / 2.26	30 / 0.48		0.6		ABS = 0.4 Fe = 0.30 Mn = 0.10		46	205	0	40 / 9	DWR
7-22-66 0200	10	63	1.2	12.4	900	7.8																			Field Determination
8-19-66 0855	15	65	5.1	53.9	870	7.7						378		83 / 2.34	62 / 1.00				PO_4 = 22 (Ortho) Fe = 0.28 ABS = 0.3 Mn = 0.03	500				44 / 8	DWR

a Sum of calcium and magnesium in epm
b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)
c Gravimetric determination
d Hach turbidity in Jackson Turbidity Units using Hach Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter
e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

SANTA ROSA CREEK AT MELITA (STATION 7)
7N/7W - 16

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents[b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity[d] in ppm Hoch / Hellige	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																		
7-9-65 0935	1 1/2	63	9.7	100	439	8.2 / 8.6	37 / 1.85	26 / 2.11	17 / 0.74	2.7 / 0.07	15 / 0.50	225 / 3.69	11 / 0.23	7.8 / 0.22	0.0 / 0.00	0.2 / 0.01	0.3		PO_4 = 0.20 Color = 5 Fe = 0.41	264	16	198	0	< 5	DWR
9-30-65 1015	1 1/2	65	8.8	93.1	400	7.9 / 8.6	/ 3.12[c]				12 / 0.40	207 / 3.39		11 / 0.31	0.3 / 0.00				PO_4 = 0.30			156	0	< 5	DWR
10-28-65 1410	3/4	67	8.6	92.9	380	8.5						220 / 3.61												< 5	Field Determination
12-17-65 0950	1.5	41	13.4	105	390	8.1 / 8.4	/ 3.50[c]				4 / 0.13	206 / 3.38		12 / 0.34	1.6 / 0.02				PO_4 = 0.10 Fe = 0.00			175	0	5	DWR
1-20-66 1510	12	48	11.9	102	328	8.3 / 8.3	/ 3.08[c]				0 / 0.00	169 / 2.77		10 / 0.28	4.7 / 0.08				PO_4 = 0.09			154	15	5	DWR
3-3-66 0810	5	42	13.0	103	285	8.3 / 8.6	42	1.4			8 / 0.27	144 / 2.36		6.4 / 0.18	2.5 / 0.04		0.2			178		111	0	13	DWR
4-15-66 1440	3	66	11.3	121	330	8.6	/ 3.40[c]				12.2	214		6.2 / 0.17	0.6 / 0.01				PO_4 = 0.11 (Ortho)			170		3.2	DWR
5-10-66 1625	3	60	12.7	127	360	8.6					12	256		8.2 / 0.23	0.8 / 0.01				PO_4 = 0.13 (Ortho)					< 5 / 1.8	DWR
6-7-66 1815	2	68	11.2	122	400	8.6	/ 3.78[c]				24	275		8.8 / 0.25	0.8 / 0.01				PO_4 = 0.20 (Ortho)			189		< 5 / 0.8	DWR
7-20-66 1620	1/2	81	10.6	131	380	8.4					18	244							Fe = 0.32 Mn = 0.11					< 5 / 2.5	DWR
8-19-66 0815	1/2	67	5.8	62.6	360	7.7						226		11 / 0.31	0.5 / 0.01				PO_4 = 0.32 (Ortho) Fe = 0.18 ABS = 0.0 Mn = 0.00	233				< 5 / 2	DWR

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hoch turbidity in Jackson Turbidity Units using Hoch Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

LAGUNA DE SANTA ROSA NEAR GRATON (STATION 8)

7N/9W - 14M

Mineral constituents in parts per million / equivalents per million

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents[b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hoch / Hellige	Analyzed by[e]
7-6-65 0950	0	64	4.6	48.1	237	7.3 / 7.6	30 / 1.50	0.7 / 0.06	19 / 0.83	5.4 / 0.14	0 / 0.00	112 / 1.84	4.3 / 0.09	11 / 0.31	6.0 / 0.10	0.2 / 0.01	0.1		PO_4 = 6.5 ABS = 0.0 Fe = 4.1 Color = 40	150	33	78	0	90	DWR
7-6-65 1625	0	72	12.7	145	225																				Field Determination
7-9-65 0355	< 1/4	62	5.4	55.2	330	7.5																			Field Determination
9-30-65 0305	0	57	3.9	37.6	220	7.1																			Field Determination
12-16-65 1700	7	44.5	5.4	44.3	530	7.0 / 7.8	2.96[c]				0 / 0.00	147 / 2.41		53 / 1.50	8.8 / 0.14				PO_4 = 2.6			148	28	40	DWR
12-17-65 0410	7	39.5	4.6	35.1		7.6																			Field Determination
1-20-66 1340	15	48	4.3	37.0	381	6.9	2.62[c]				0 / 0.00	119 / 1.95		30 / 0.85	9.6 / 0.15				PO_4 = 2.8			131	33	110	DWR
1-21-66 0345	15	42	4.5	35.6		6.9																			Field Determination
3-3-66 1400	12	53	7.2	66.1	319	7.1 / 8.3	25	10			0 / 0.00	124 / 2.03		26 / 0.73	6.3 / 0.10		0.1			210		105	3	112	DWR
3-4-66 0240	10	48	6.2	53.4		7.0																			Field Determination
4-14-66 1630	6	72	8.9	101	520	7.5	3.44[c]					238		50 / 1.41	2.6 / 0.04				PO_4 = 4.0 (Ortho) ABS = 0.0			172		56	DWR
4-15-66 0335	6	63	4.8	49.6	570	7.3																			Field Determination

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hoch turbidity in Jackson Turbidity Units using Hoch Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

LAGUNA DE SANTA ROSA NEAR GRATON (STATION 8)
7N/9W - 14M

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field/Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents b	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity[d] in ppm Hach/Hellige	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																		
5-11-66 1620	4	71	8.9	214	530	7.5						275		56/1.58	2.0/0.03		0.1		PO_4 = 7.8 (Ortho) ABS = 0.0					55/26	DWR
5-12-66 0340	4	63	1.1	11.4	530	7.3																			Field Determination
6-9-66 1500	4	72	9.4	107	280	7.3/8.3	1.46[a]				0/0.00	124/2.03		12/0.34	3.6/0.06				PO_4 = 7.9 (Ortho) ABS = 0.1			73	0	55/21	DWR
6-10-66 0200	4	64	2.5	26.1	280	7.3																			Field Determination
7-21-66	Dry																								
8-19-66	Dry																								

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hach turbidity in Jackson Turbidity Units using Hach Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

MARK WEST CREEK NEAR FULTON (STATION 9)

8N/8W - 28N

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents[b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hach / Hellige	Analyzed by[e]
7-7-65 0710	3	65	6.0	63.4	331	7.3 / 8.3	31 / 1.55	16 / 1.31	16 / 0.70	3.9 / 0.10	0 / 0.00	185 / 3.03	9.2 / 0.19	13 / 0.37	1.3 / 0.02	0.1 / 0.00	0.3		PO_4 = 0.13 Color = 5 Fe = 0.12	182	19	143	0	< 10	DWR
9-30-65 0940	1	64	7.1	74.2	400	7.5 / 8.6	3.20[c]				12 / 0.40	193 / 3.16		16 / 0.45	1.1 / 0.02				PO_4 = 0.15			160	0	< 5	DWR
10-27-65 1515	2.5	68	13.3	145	380	8.3					0 / 0.00	214 / 3.51												< 5	Field Determination
12-16-65 0840	4	39.5	11.8	90.1	290	7.5 / 8.2	2.34[c]				0 / 0.00	144 / 2.36		13 / 0.37	0.6 / 0.01				PO_4 = 0.20			117	0	< 5	DWR
1-20-66 0820	12	39	12.4	94.0	219	7.5 / 7.9	1.84[c]				0 / 0.00	103 / 1.69		7.7 / 0.22	2.3 / 0.4				PO_4 = 0.16			92	8	11	DWR
3-2-66 1230	25	50	12.8	113	161	7.5 / 8.3	22	4.6			0 / 0.00	83 / 1.36		5.4 / 0.15	1.1 / 0.02		0.1			125		74	6	17	DWR
4-15-66 1405	4	73	11.6	134	210	8.5	1.80[c]					134		6.2 / 0.17	0.4 / 0.01				PO_4 = 0.12 (Ortho)			90		5.7	DWR
5-9-66 1220	2	62	9.3	95.0	210	7.7						98		9.8 / 0.28	1.1 / 0.02				PO_4 = 0.19 (Ortho)					< 5 / 1.5	DWR
6-7-66 1730	1	73	10.3	119	320	8.2	2.44[c]					189		10 / 0.28	1.3 / 0.02				PO_4 = 0.19 (Ortho)			122		< 5 / 0.9	DWR
7-18-66 1645	1/2	83	8.7	110	370	7.8						207		21 / 0.59	1.4 / 0.02		0.4		PO_4 = 0.17 (Ortho) Fe = 0.04 Mn = 0.07					< 5 / 0.3	DWR
8-18-66 1630	1/2	79	9.2	113	430	7.9						220		38 / 1.07	1.4 / 0.02				PO_4 = 0.21 Fe = 0.03 Mn = 0.0 ABS = 0.0	244				< 5 / 0.7	DWR

Mineral constituents in parts per million / equivalents per million

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hach turbidity in Jackson Turbidity Units using Hach Portable Engineers Laboratory, Hellige turbidity in A P H A Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

MILL CREEK (STATION 10)

9N/9W - 33K

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen % Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents[b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hoch / Hellige	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																		
7-6-65 1350	2	72	9.8	112	190	7.5 / 8.3	17 / 0.85	9.4 / 0.77	9.8 / 0.43	1.1 / 0.03	0 / 0.00	100 / 1.64	8.6 / 0.18	6.8 / 0.19	0.1 / 0.02	0.1 / 0.00	0.0		PO_4 = 0.10 Color = 0 Fe = 0.02	112	21	81	0	8	DWR
12-16-65 1205	10	45	12.9	107	210	7.7 / 8.2	/ 1.70[a]				0 / 0.00	102 / 1.67		6.8 / 0.19	0.9 / 0.01				PO_4 = 0.09			85	1	< 5	DWR
1-20-66 0935	10	42.5	12.8	102	169	7.5 / 8.0	/ 1.44[a]				0 / 0.00	80 / 1.31		5.8 / 0.16	1.0 / 0.02				PO_4 = 0.13			72	6	< 5	DWR
3-1-66 1415	15	50	11.9	105	162	7.5 / 8.3	13	6.4			0 / 0.00	86 / 1.41		4.4 / 0.12	0.6 / 0.01		0.1			100		59	0	< 5	DWR
4-14-66 0855	8	56	11.5	110	210	7.9	/ 1.56[a]					110		1.9 / 0.05	0.3 / 0.00				PO_4 = 0.11 (Ortho)			78		3.2	DWR
5-9-66 1320	2	58	10.0	97.6	178	7.6						104		5.2 / 0.15	0.0 / 0.00				PO_4 = 0.14 (Ortho)					< 5 / 1	DWR
6-9-66 1410	2	73	9.7	112	200	7.7	/ 1.42[a]					110		4.7 / 0.13	0.7 / 0.01				PO_4 = 0.12 (Ortho)			71		< 5 / 0.4	DWR
7-20-66	Dry																								
8-18-66	Dry																								

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hoch turbidity in Jackson Turbidity Units using Hoch Portable Engineers Laboratory, Hellige turbidity in A P H A Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

DRY CREEK NEAR GEYSERVILLE (STATION 11)
10N/10W - 22L

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents[b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hoch / Hellige	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																		
7-6-65 1425	12	77	11.1	133	272	8.0 / 8.5	28 / 1.40	13 / 1.06	12 / 0.52	1.2 / 0.03	5 / 0.17	143 / 2.34	16 / 0.33	6.6 / 0.19	1.4 / 0.02	0.1 / 0.00	0.3		PO_4 = 0.07 Color = 0 Fe = 1.6	161	17	123	0	45	DWR
9-29-65 0900	1.2	61	9.0	91.0	280	7.5 / 8.4	2.50[c]				4 / 0.13	141 / 2.31		5.0 / 0.14	0.5 / 0.01				PO_4 = 0.07 Fe = 0.45			125	3	≤ 5	DWR
10-27-65 1135	3.4	71	13.4	151	285	8.4	30.1 / 1.50	10.9 / 0.90			0 / 0.00	152 / 2.49										120	0	≤ 5	Field Determination
12-16-65 1005	91	44.5	11.4	93.5	269	7.5 / 8.3	2.28[c]				0 / 0.00	135 / 2.21		6.2 / 0.17	0.8 / 0.01		0.3		PO_4 = 0.07			114	3	≤ 5	DWR
1-19-66 1445	252	51	11.1	99.3	234	7.9 / 8.0	2.14[c]				0 / 0.00	113 / 1.85		4.7 / 0.13					PO_4 = 0.08			107	14	5	DWR
3-1-66 1330	394	52.5	11.1	101	204	7.5 / 8.3	20	7.8			0 / 0.00	109 / 1.79		3.2 / 0.09	1.1 / 0.02		0.1			124		82	0	20	DWR
4-12-66 1540	228	63	9.9	102	220	8.1	1.86[c]					122		3.8 / 0.11	0.6 / 0.01		0.1		PO_4 = 0.11 (Ortho)			93		63	DWR
5-11-66 0850	55	60	9.6	95.9	245	7.6						146		4.9 / 0.14	0.8 / 0.01		0.3		PO_4 = 0.05 (Ortho)					≤ 5 / 1.3	DWR
6-9-66 0915	23	67	10.3	111	250	7.7	2.30[c]					153		3.9 / 0.11	0.8 / 0.01				PO_4 = 0.05 (Ortho)			115		≤ 5 / 1.0	DWR
7-18-66 1500	3.2	79	11.6	142	230	8.1						153					0.2							≤ 5 / 0.3	DWR
8-18-66 1430	1.8	77	8.8	106	260	7.7						153		5.3 / 0.15	0.0 / 0.00				PO_4 = 0.03 (Ortho) Fe = 0.04 Mn = 0.03	140				≤ 5 / 0.25	DWR

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hoch turbidity in Jackson Turbidity Units using Hoch Portable Engineers Laboratory, Hellige turbidity in A P H A Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

WARM SPRINGS CREEK (STATION 12)
10N/11W - 24Q

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents [b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hoch / Hellige	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																		
7-6-65 1500	4	83	11.4	145	281	8.8 / 8.7	24 / 1.20	11 / 0.88	25 / 1.09	1.8 / 0.05	10 / 0.33	142 / 2.33	13 / 0.27	7.4 / 0.21	0.4 / 0.01	0.2 / 0.01	1.5		PO_4 = 0.07 Color = 0 Fe = 0.08	164	34	104	0	< 5	DWR
9-29-65 0830	2	64	9.9	104	490	8.0 / 8.6	2.40[c]				20 / 0.67	246 / 4.03		8.6 / 0.24	0.5 / 0.01				PO_4 = 0.15			120	0	< 5	DWR
10-27-65 1105	1.5	69	14.8	163	585	8.5	30.1 / 1.50	10.9 / 0.90														120		< 5	Field Determination
12-16-65 1110	6.8	44	12.7	103	245	7.7 / 8.3	1.96[c]				0 / 0.00	125 / 2.05		5.6 / 0.16	0.3 / 0.00		0.5		PO_4 = 0.08			98	0	< 5	DWR
1-19-66 1530	12	50	11.8	104	183	8.1 / 8.0	1.68[c]				0 / 0.00	89 / 1.46		4.5 / 0.13	0.4 / 0.01		0.0		PO_4 = 0.07			84	11	< 5	DWR
3-1-66 1300	20	50.5	11.5	102	168	7.5 / 8.3	18	5.4			0 / 0.00	90 / 1.48		3.4 / 0.10	0.5 / 0.01		0.1			104		67	0	< 5	DWR
4-12-66 1520	20	62	10.4	106	190	8.3	1.64[c]					116		3.6 / 0.10	0.1 / 0.00				PO_4 = 0.08 (Ortho)			82		6.8	DWR
5-11-66 0925	10	60	10.1	101	225	8.0						134		4.2 / 0.12	0.3 / 0.00		0.6		PO_4 = 0.10 (Ortho)					< 5 / 1.3	DWR
6-9-66 0840	8	68	9.7	106	260	8.3	1.80[c]					146		4.4 / 0.12	0.5 / 0.01				PO_4 = 0.08 (Ortho)			90		< 5 / 0.8	DWR
7-18-66 1430	1	83	12.4	155	310	8.7						207					2.3							< 5 / 0.9	DWR
8-18-66 1400	1/2	80	5.8	71.3	480	8.1						348		10 / 0.28	0.6 / 0.01				PO_4 = 0.16 (Ortho) Fe = 0.21 Mn = 0.00	320				< 5 / 1.7	DWR

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hoch turbidity in Jackson Turbidity Units using Hoch Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

DRY CREEK NEAR YORKVILLE (STATION 13)
12N/12W-15G

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen		Specific conductance (micromhos at 25°C)	pH	Mineral constituents in parts per million / equivalents per million													Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$		Turbidity[d] in ppm	Analyzed by[e]
			ppm	% Sat		Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents[b]			Total ppm	N C ppm	Hach / Hellige	
7-7-65 1450	1/2	77	8.4	101	200	7.3																		< 5	Field Determination
9-28-65 1115	1/4	71	8.0	90.2	250	7.1 / 8.5	2.28[c]				4 / 0.13	131 / 2.15		7.0 / 0.20	1.1 / 0.02				PO_4 = 0.05			114	0	< 5	DWR
10-27-65 0940	1/4	65	4.6	48.6	270	7.0	24 / 1.20	12 / 1.00			0 / 0.00	140 / 2.30										110	0	< 5	Field Determination
12-15-65 1040	3	47	11.7	99.3	162	7.7 / 8.2	1.60[c]				0 / 0.00	93 / 1.52		7.0 / 0.20	0.5 / 0.01				PO_4 = 0.02			80	4	< 5	DWR
1-18-66 1520	10	50	11.2	98.9	151	7.3	1.20[c]				0 / 0.00	67 / 1.10		6.7 / 0.19	1.0 / 0.02				PO_4 = 0.05			60	5	9	DWR
3-1-66 1130	8	50	11.5	102	132	7.5 / 8.2	13	6.0			0 / 0.00	66 / 1.08		4.4 / 0.12	0.6 / 0.01		0.0			88		57	3	6	DWR
4-12-66 1400	5	61	10.2	103	160	8.0	1.30[c]					85		4.3 / 0.12	0.2 / 0.00				PO_4 = 0.05 (Ortho)			65		7.4	DWR
5-10-66 1450	1.5	65	10.2	108	180	8.1						122		5.8 / 0.16	0.1 / 0.00				PO_4 = 0.10 (Ortho)					< 5 / 1.8	DWR
6-7-66 1630	1	67	9.2	99.4	240	7.1	1.62[c]					116		4.7 / 0.13	0.6 / 0.01				PO_4 = 0.04 (Ortho)			81		< 5 / 0.5	DWR
7-20-66 1440	1/2	77	7.3	88.3	230	7.5						128					0.1							< 5 / 1.2	DWR
8-17-66 1730	0																								

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hach turbidity in Jackson Turbidity Units using Hach Portable Engineers Laboratory, Hellige turbidity in A P H A Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

RUSSIAN RIVER NEAR HEALDSBURG (STATION 14)
9N/9W-22H

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen % Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents[b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hach / Hellige	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																		
7-7-65 1510	116	75	9.85	115.7	245	8.0																		9	Field Determination
7-13-65 1230	140	76	9.6	114.0	282	8.2 / 8.3	2.68[c]		9.6 / 0.42		0.00 / 0.00	158 / 2.59		5.4 / 0.15			0.3				14	134	4	4	USGS
9-14-65 1505	199	78	8.0	96.9	251	8.4 / 8.0	26 / 1.30	12 / 1.02	8.3 / 0.36	1.3 / 0.03	0 / 0.00	140 / 2.29	10 / 0.21	4.0 / 0.11	0.8 / 0.01		0.2	13	ABS = 0.0 As = 0.0 PO_4 = 0.05	148	13	116	1	2	USGS
9-29-65 1030	240	65	8.8	93	250	7.8																		19	Field Determination
10-28-65 0935	261	63	8.6	88.9	261	8.2						140 / 2.29												6	Field Determination
11-10-65 1410	324	60	11.5	115	257	8.2 / 8.4	2.38[c]		8.4 / 0.37		4 / 0.13	134 / 2.20		4.3 / 0.12			0.5				13	119	3	3	USGS
12-16-65 0920	568	44	11.3	92.0	265	7.7 / 8.3	2.48[c]				0 / 0.00	143 / 2.34		6.5 / 0.18	1.7 / 0.03				PO_4 = 0.09 Fe = 0.01			124	7	6	DWR
1-19-66 0900	1540	41	10.9	85.1	277	7.6 / 7.9	2.56[c]		8.2 / 0.36		0 / 0.00	146 / 2.39		3.8 / 0.11			0.2				12	128	8	10	USGS
1-20-66 0855	1410	45	11.2	92.5	260	7.9						140												10	Field Determination
3-1-66 1440	1420	52	11.3	102		8.3						146												20	Field Determination
3-8-66 1300	1280	51	13.3	119	237	7.6 / 8.4	2.18[c]		7.7 / 0.33		3 / 0.10	128 / 2.00		3.1 / 0.09			0.1				13	109	4	10	USGS
4-13-66 0855	936	56	10.2		230	7.9	1.98[c]					128		4.0 / 0.11	1.8 / 0.03				PO_4 = 0.21 (Ortho)			99		91	DWR

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hach turbidity in Jackson Turbidity Units using Hach Portable Engineers Laboratory, Hellige turbidity in A P H A Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

RUSSIAN RIVER NEAR HEALDSBURG (STATION 14)
9N/9W-22H

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents[b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hach / Hellige	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																		
5-3-66 0945	15	63	10.1	104	262	8.0 / 8.1	26 / 1.30	13 / 1.10	8.8 / 0.38	1.1 / 0.03	0 / 0.00	145 / 2.38	14 / 0.29	5.2 / 0.15	1.5 / 0.02		0.3	13	ABS = 0.0; PO_4 = 0.06 (Ortho); As = 0.00	154	14	120	1	1	USGS
5-9-66 1250	465	64	9.2	96.1	240	8.1						134							PO_4 = 0.10 (Ortho)					46 / 40	DWR
6-9-66 1315	290	74	10.1	118	300	8.3								4.8 / 0.14	2.0 / 0.03				PO_4 = 0.06 (Ortho)			122		< 5 / 4.2	DWR
7-12-66 0740		70	8.0	89.3	259	7.9 / 8.4	/ 2.44		8.2 / 0.36		4 / 0.13	147 / 2.28		3.8 / 0.11			0.2				13	122	1	3	USGS
7-21-66 0930	158	74	8.9	104	270	8.1						159							ABS = 0.0					< 5 / 1.9	DWR
8-18-66 1630	207	78	9.6	116	250	8.2						153		5.2 / 0.15	0.2 / 0.00				PO_4 = 0.04 (Ortho); Fe = 0.24; Mn = 0.00	121				< 5 / 2.9	DWR

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hach turbidity in Jackson Turbidity Units using Hach Portable Engineers Laboratory, Hellige turbidity in A P H A Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

REGION 1

Date and time sampled	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total Dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity in ppm	Coliform[d] MPN/ml	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																			
											Russian River near Healdsburg															
1951																										
Apr 8 1615	694	64	8.8	92	255	7.6			10.5 / 0.457		0 / 0.00	141 / 2.31		5.5 / 0.155								119		8		USGS
May 8 1130	1,070	59	9.0	89	243	7.5	24 / 1.20	13 / 1.07	6.4 / 0.278	0.9 / 0.023	0 / 0.00	133 / 2.18	14 / 0.29	4.2 / 0.118	1.4 / 0.023		0.59	16		145[b]	11	113	4			USGS

a Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and chromium (Cr), reported here as $\frac{0.0}{0.00}$ except as shown.

b Determined by addition of analysed constituents

c Gravimetric determination.

d Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by Calif. Dept of Public Health, Division of Laboratories.

e Mineral analyses made by USGS, Quality of Water Branch (USGS), Pacific Chemical Consultant (PCC), Metropolitan Water District (MWD), Los Angeles Dept. of Water & Power (LADWP), City of Los Angeles Dept of Pub Health (LADPH), Long Beach Dept. of Pub Health (LBDPH) & State Division of Water Resources (DWR), as indicated

Date and time sampled	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity in ppm	Coliform[d] MPN/ml	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																			
											Russian River near Healdsburg															
1951 (continued)																										
Jun 13 1145	245	73	8.4	97	292	7.8					0 / 0.00	173 / 2.84		6.1 / 0.172								130		25		DWR
Jul 11 1230	161	70	7.8	80	305	8.0					0 / 0.00	168 / 2.75		5.0 / 0.141								138		25		DWR
Aug 16 1740	116	78	8.8	106	279	8.0					0 / 0.00	166 / 2.72		8.0 / 0.226								132		25		DWR
Sep 9 1210	131	73	8.2	93	281	7.8	28 / 1.40	15 / 1.23	11 / 0.48	1.0 / 0.025	0 / 0.00	162 / 2.66	12 / 0.25	5.5 / 0.115	0.2 / 0.003	0 / 0.00	0.67	14		166[b]	15	132	0			USGS
Oct 9 1330	206	66	8.8	94	272	7.3			10 / 0.43		0 / 0.00	150 / 2.46		7.0 / 0.197							15	121	0	0		USGS
Nov 13 1240	436	56	10.2	97	258	7.8			8.0 / 0.35		0 / 0.00	140 / 2.29		5.2 / 0.147							13	122	8	0	23 0.23–7,000+	USGS
Dec 10 1135	1,750	47	11.0	93	227	7.8						124 / 2.03		4 / 0.11								100		50		
1952																										
Jan 9 1215	3,330	46	11.2	93	195	7.4					0 / 0.00	108 / 1.77		4 / 0.11								86		80		DWR
Feb 11 1130	2,930	51	10.2	91	214	7.5			6.4 / 0.278		0 / 0.00	116 / 1.90		4.5 / 0.127							12	99	4	65		USGS
Mar 6	3,290	46	11.2	93	202	7.6			6.4 / 0.278		0 / 0.00	107 / 1.75		5.2 / 0.147							13	92	4	200		USGS
Apr 21 1120	753	63	11.4	116	240	7.8					0 / 0.00	140 / 2.29		4 / 0.11								116		4		DWR
May 19 1145	516	75	8.4	98	241	8.4	22 / 1.10	13 / 1.07	8.1 / 0.352	0.9 / 0.023	0 / 0.00	133 / 2.18	11 / 0.23	5.5 / 0.155	0.6 / 0.010	0.2 / 0.011	0.65	23	Sn 0.20 (a)	150[b]	14	108	0			USGS
Jun 16 1115	356	73	9.0	104	237	8.6					0 / 0.00	138 / 2.26		5 / 0.14								110		3		DWR
Jul 7 1305	212	75	7.0	82	280	8.4					0 / 0.00	155 / 2.54		7 / 0.20								128				DWR
Aug 4 1320	240				238	8.2	22 / 1.10				0 / 0.00	140 / 2.29		8.0 / 0.226	0 / 0.00							110		3.5		DWR

a Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and chromium (Cr), reported here as $\frac{0.0}{0.00}$ except as shown.

b Determined by addition of analyzed constituents

c Gravimetric determination.

d Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by Calif. Dept of Public Health, Division of Laboratories

e Mineral analyses made by USGS, Quality of Water Branch (USGS), Pacific Chemical Consultant (PCC), Metropolitan Water District (MWD), Los Angeles Dept. of Water & Power (LADWP), City of Los Angeles Dept of Pub Health (LADPH), Long Beach Dept of Pub Health (LBDPH) & State Division of Water Resources (DWR), as indicated

ANALYSES OF SURFACE WATER

REGION 1

Date and time sampled	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity in ppm	Coliform[d] MPN/ml	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																			
											Russian River near Healdsburg															
1952 (continued)																										
Sep 15 1318	189	71	10.4	118	242	7.8					0 / 0.00	139 / 2.281		5.0 / 0.141								111				USGS
Oct 6 1330	168	63	9.6	98	252	7.5	26 / 1.30	11 / 0.90	13 / 0.57	1.1 / 0.028	0 / 0.00	143 / 2.34	8.3 / 0.173	5.8 / 0.164	0.8 / 0.013	0.0 / 0.00	0.86	98	Mn 0.01; (a)	146[b]	20	110	0			USGS
Nov 3 1035	222	58	10.2	99	244	7.8					0 / 0.00	138 / 2.26		4 / 0.11								108		2		DWR
Dec 2 0740	2,950	45	10.4	86	178	6.9					0 / 0.00	69 / 1.13		3 / 0.008								75		350	14 0.23–7,000+	DWR
1953																										
Jan 12 1130	7,160	58	10.6	103	183	6.3	16 / 0.80	9.7 / 0.798	7.4 / 0.322	1.2 / 0.031	0 / 0.00	97 / 1.59		4.2 / 0.118							17	80	0			USGS
Feb 9 1530	1,000	60	10.6	106	273	7.4	27 / 1.35	14 / 1.15	9.2 / 0.400	1.0 / 0.026	0 / 0.00	150 / 2.46		6.0 / 0.169							14	125	2			USGS
Mar 9 1330	624	56	10.8	102	238	7.6	24 / 1.20	13 / 1.07	8.2 / 0.357		0 / 0.00	132 / 2.16		4.5 / 0.127			0.42				14	113	5			USGS
Apr 6 1330	864	60	10.8	108	243	7.8	24 / 1.20	12 / 0.99	8.0 / 0.348		0 / 0.00	132 / 2.16		4.5 / 0.127			0.44				14	109	1	15		USGS
May 4 1515	1,000	67	9.2	99	235	7.3	23 / 1.15	12 / 0.99	8.7 / 0.378	1.1 / 0.028	0 / 0.00	126 / 2.07	12 / 0.25	5.5 / 0.155	1.6 / 0.026	0.2 / 0.011	0.34	16	Zn 0.02 (a)	142[b]	15	107	4	10		USGS
Jun 8 1410	678	64	11.4	119	238	7.8					0 / 0.00	128 / 2.10		5 / 0.14			0.23				19	78		12		DWR
Jul 6 1400	133	78	9.6	116	234	7.4			7.7 / 0.334		0 / 0.00	131 / 2.15		5 / 0.14			0.67				13	112		4		DWR
Aug 3 1120	273	66	8.8	94	242	7.3	25 / 1.25	12 / 0.99	9.2 / 0.400	1.1 / 0.028	0 / 0.00	132 / 2.16		6.2 / 0.174			0.58				15	112	4	2		USGS
Sep 14 1350	238	78	8.3	100	238	8.1	23 / 1.15	12 / 0.99	9.2 / 0.400	1.0 / 0.026	0 / 0.00	133 / 2.18	9.6 / 0.200	5.0 / 0.141	0.4 / 0.006	0.0 / 0.00	0.93	14	Fe 0.02 (a)	140[b]	16	107	0	1		USGS
Oct 5 1127	265	70	9.6	106	237	7.9	24 / 1.20	11 / 0.90	10 / 0.43	1.0 / 0.026	0 / 0.00	132 / 2.16		5.0 / 0.141			0.73				17	105	0	1		USGS
Nov 2 1015	231	56	10.1	96	258	7.4			10.1 / 0.439		0 / 0.00	138 / 2.26		6 / 0.17			1.0				16	116		2		DWR

a Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and chromium (Cr), reported here as $\frac{00}{000}$ except as shown.

b Determined by addition of analysed constituents

c Gravimetric determination.

d Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by Calif. Dept of Public Health, Division of Laboratories.

e Mineral analyses made by USGS, Quality of Water Branch (USGS), Pacific Chemical Consultant (PCC), Metropolitan Water District (MWD), Los Angeles Dept. of Water & Power (LADWP), City of Los Angeles Dept. of Pub Health (LADPH), Long Beach Dept of Pub Health (LBDPH) & State Division of Water Resources (DWR), as indicated

ANALYSES OF SURFACE WATER

REGION 1

Date and time sampled	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO3)	Bicarbonate (HCO3)	Sulfate (SO4)	Chloride (Cl)	Nitrate (NO3)	Fluoride (F)	Boron (B)	Silica (SiO2)	Other constituents[a]	Total Dissolved solids in ppm	Percent sodium	Hardness as CaCO3 Total ppm	Hardness as CaCO3 N.C. ppm	Turbidity in ppm	Coliform[d] MPN/ml	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																			
											Russian River near Healdsburg															
1953 (continued)																										
Dec 7 1105	1,260	53	10.5	96	235	6.9	22 / 1.10	12 / 0.99	8.2 / 0.357	1.1 / 0.028	0 / 0.00	120 / 1.97		5.5 / 0.155			0.43				14	104	16	40	2.3 0.13-7,000+	USGS
1954																										
Jan 4 1155	614	52	12.3	111	248	7.9	24 / 1.20	12 / 0.99	8.4 / 0.365	1.0 / 0.026	0 / 0.00	133 / 2.18		7.8 / 3.20			0.63				14	109	0	6		USGS
Feb 1 1320	2,590	55	10.1	95	200	7.2	19 / 0.95	10 / 0.82	5.8 / 0.252	1.0 / 0.026	0 / 0.00	106 / 1.74		3.2 / 0.090			0.19				12	88	2	47		USGS
Mar 1 1018	1,390	55	10.5	99	237	6.4	22 / 1.10	13 / 1.07	8.2 / 0.357	0.8 / 0.020	0 / 0.00	126 / 2.05		3.5 / 0.099			0.21				14	108	5	22		USGS
Apr 5 1019	14,500	57	9.1	87	128	7.3	12 / 0.60	6.0 / 0.493	5.2 / 0.226	2.7 / 0.069	0 / 0.00	66 / 1.08		1.5 / 0.042			0.17				16	55	0	264		USGS
May 3 1115	926	64	10.5	109	249	7.4	25 / 1.25	12 / 0.99	7.8 / 0.339	0.8 / 0.020	0 / 0.00	135 / 2.21	11 / 0.23	3.6 / 0.102	0.4 / 0.006	0.1 / 0.005	0.38	14	Al 0.02; Fe 0.01 Zn 0.05 (e)	141[b]	13	112	1	2		USGS
Jun 10 1100	398	64	9.6	100	254	7.3	27 / 1.35	12 / 0.99	6.9 / 0.300	1.2 / 0.031	0 / 0.00	138 / 2.26	10 / 0.21	6.2 / 0.175			0.78				11	117	4	11		USGS
Jul 12 1145	142	80	8.1	100	291	7.8	29 / 1.45	15 / 1.23	12 / 0.52	1.4 / 0.036	6 / 0.20	156 / 2.56		8.5 / 0.240			1.1				16	134	0	1		USGS
Aug 2 1400	152	76	8.5	100	313	7.7	29 / 1.45	14 / 1.15	14 / 0.61	1.5 / 0.038	0 / 0.00	166 / 2.72		9.0 / 0.254			2.2				19	130	0	0.5		USGS
Sep 13 1420	310	72	9.0	102	273	7.6	25 / 1.25	12 / 0.99	14 / 0.61	1.3 / 0.033	0 / 0.00	145 / 2.37	9.3 / 0.194	9.8 / 0.276	0.3 / 0.005	0.1 / 0.005	2.9	13	Al 0.01; Cu 0.01 Fe 0.01 (e)	159[b]	21	112	0	2		USGS
Oct 4 1130	291	64	9.6	100	255	7.8	25 / 1.25	12 / 0.99	9.6 / 0.417	1.2 / 0.031	0 / 0.00	140 / 2.29		7.0 / 0.197			1.1	14			16	110	0	1		USGS
Nov 7 1000	184	60	9.2	92	267	7.3	28 / 1.40	13 / 1.08	14 / 0.61	1.2 / 0.031	0 / 0.00	158 / 2.59		10 / 0.28			2.5				20	124	0	0.9		USGS
Dec 6 1120	10,200		11.2		133	7.8	14 / 0.70	6.5 / 0.531	4.2 / 0.183	3.2 / 0.082	0 / 0.00	70 / 1.15		2.5 / 0.071			0.28				12	62	5	1000	17 0.23-2300	USGS

a Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and chromium (Cr), reported here as $\frac{0.0}{0.00}$ except as shown.

b Determined by addition of analyzed constituents

c Gravimetric determination.

d Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by Calif. Dept of Public Health, Division of Laboratories

e Mineral analyses made by USGS, Quality of Water Branch (USGS), Pacific Chemical Consultant (PCC), Metropolitan Water District (MWD), Los Angeles Dept. of Water & Power (LADWP), City of Los Angeles Dept of Pub Health (LADPH), Long Beach Dept of Pub Health (LBDPH) & State Division of Water Resources (DWR), as indicated

ANALYSES OF SURFACE WATER

REGION 1

Date and time sampled	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents[a]	Total dissolved solids in ppm	Per cent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity in ppm	Coliform[d] MPN/ml	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																			
Russian River near Healdsburg																										
1955																										
Jan 3 1430	1,520	48	11.7	101	192	7.1	19 / 0.948	9.6 / 0.792	7.7 / 0.335	1.3 / 0.C33	0 / 0.000	102 / 1.672		4.5 / 0.127			0.39				16	87	3	45		USGS
Feb 7 1100	926	52	11.4	103	257	7.4	25 / 1.248	12 / 0.992	12 / 0.522	0.9 / 0.023	0 / C.C00	136 / 2.229		7.8 / 0.220			1.2				19	112	0	7		USGS
Mar 6 1230	908	52	11.6	105	242	7.6	21 / 1.048	14 / 1.124	8.4 / 0.365	1.1 / 0.028	0 / 0.C00	132 / 2.163		5.3 / 0.149			0.34				14	109	1	2		USGS
Apr 4 1045	324	58	11.0	107	293	8.2	27 / 1.347	16 / 1.325	11 / 0.478	1.0 / C.026	0 / 0.000	168 / 2.753		7.1 / 0.200			0.84				15	134	0	2		USGS
May 2 1030	1,390	60	9.5	95	234	6.9	25 / 1.248	11 / 0.872	8.7 / 0.378	0.9 / 0.023	0 / 0.000	129 / 2.114	13 / 0.271	7.5 / 0.212	0.6 / 0.010	0.1 / 0.005	0.16	5.6	Mn 0.01; Pb 0.005; (a) PO_4 0.10	137[b]	15	106	0	10		USGS
Jun 23 1110	196	70	7.8	87	306	7.2	31 / 1.547	12 / 1.025	16 / 0.696	1.5 / C.038	0 / 0.000	164 / 2.688		11 / 0.310			2.5		Al 0.08; Zn 0.01; (a)		21	129	0	1		USGS
Jul 11 1100	180	74	8.	89	309	7.3	27 / 1.347	15 / 1.193	17 / 0.739	1.2 / 0.031	0 / 0.C00	171 / 2.802		12 / 0.338			3.1				22	127	0	1		USGS
Aug 1 110C	141	72	8.C	91	314	7.3	27 / 1.347	15 / 1.213	16 / 0.696	1.2 / 0.031	0 / 0.000	173 / 2.835		12 / 0.338			3.3				21	128	0	1		USGS
Sep 12 133C	170	74	8.6	100	305	7.3	28 / 1.397	12 / 0.971	18 / 0.783	1.2 / 0.031	0 / 0.000	164 / 2.688	7.8 / 0.162	12 / 0.338	0.1 / 0.002	0.1 / 0.005	3.5	12	Fe 0.02; Al 0.07; Cu 0.01; (a)	176[b]	25	118	0	2.0		USGS
Oct 3 1400	192	69	9.6	106	303	7.7	27 / 1.347	14 / 1.161	19 / 0.826	1.2 / 0.031	0 / 0.000	163 / 2.672		11 / 0.310			4.3				25	125	0	2		USGS
Nov 14 1245	279	50	11.0	97	245	6.9	26 / 1.297	11 / 0.875	11 / 0.478	1.1 / 0.028	0 / 0.000	137 / 2.245		6.7 / 0.189			1.4				18	109	0	C.6		USGS
Dec 5 1125	328	50	8.0	70	257	7.0	28 / 1.397	10 / 0.823	11 / 0.478	1.1 / 0.028	0 / 0.000	133 / 2.180		7.8 / 0.220			1.4				18	111	2	13	median 13	USGS
																									minimum .13	
																									maximum 620	

a Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and chromium (Cr), reported here as $\frac{0.0}{0.00}$ except as shown.

b Determined by addition of analysed constituents

c Gravimetric determination.

d Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by Calif. Dept. of Public Health, Division of Laboratories.

e Mineral analyses made by USGS, Quality of Water Branch (USGS), Pacific Chemical Consultant (PCC), Metropolitan Water District (MWD), Los Angeles Dept. of Water & Power (LADWP), City of Los Angeles Dept of Pub Health (LADPH), Long Beach Dept. of Pub Health (LBDPH) or State Division of Water Resources (DWR), as indicated

ANALYSES OF SURFACE WATER

REGION 1

Date and time sampled	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total Dissolved solids in ppm	Per cent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity in ppm	Coliform[d] MPN/ml	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																			
											Russian River near Healdsburg															
1956																										
Jan 16 1130	31,900	53	10.0	92	108	6.8	10 / 0.499	5.1 / 0.421	3.2 / 0.139	2.3 / 0.059	0 / 0.000	58 / 0.951		2.0 / 0.056			0.11				12	46	0	950		USGS
Feb 17 1345	1,080	46	10.0	84	256	6.8	24 / 1.198	12 / 1.026	10 / 0.435	1.2 / 0.031	0 / 0.000	139 / 2.278		4.2 / 0.118			1.1				16	111	0	30		USGS
Mar 5 1115	3,210	51	11.0	98	215	7.1	20 / 0.998	11 / 0.902	8.6 / 0.374	1.0 / 0.026	0 / 0.000	117 / 1.918		6.5 / 0.183			0.66				16	95	0	60		USGS
Apr 2 1000	852	56	10.4	99	261	8.4	22 / 1.098	14 / 1.142	12 / 0.522	1.3 / 0.033	0 / 0.000	150 / 2.458		2.5 / 0.070			1.5				19	112	0	15		USGS
May 7 1110	857	64	10.4	108	252	7.9*	28 / 1.397	9.8 / 0.803	11 / 0.478	1.2 / 0.031	0 / 0.000	140 / 2.295	12 / 0.250	4.6 / 0.130	1.3 / 0.021	0.3 / 0.016	1.2	16	Fe 0.02; Al 0.05; Cu 0.01; PO_4 0.10 (a)	154[b]	18	110	0	20		USGS
June 11 1400	226	76	9.0	106	298	7.7	27 / 1.347	15 / 1.201	15 / 0.652	1.4 / 0.036	0 / 0.000	166 / 2.721		8.5 / 0.240			2.4				20	127	0	2		USGS
July 2 1000	160	75	8.0	94	313	8.2	29 / 1.447	16 / 1.333	16 / 0.696	1.4 / 0.036	0 / 0.000	177 / 2.901		10 / 0.282			2.8				20	139	0	1		USGS
Aug 6 1130	140	78	8.3	100	307	7.2	27 / 1.347	15 / 1.253	18 / 0.783	1.3 / 0.033	0 / 0.000	174 / 2.852		12 / 0.338			3.4				23	130	0	2		USGS
Sept 0945	145	71	9.0	101	287	6.9	27 / 1.347	14 / 1.125	14 / 0.609	1.4 / 0.036	0 / 0.000	165 / 2.704	8.1 / 0.169	9.1 / 0.257	0.6 / 0.010	0.0 / 0.000	2.1	17	Cu 0.01; PO_4 0.05; (a)	174[b]	36	124	0	0.4		USGS
Oct 18 1300	210	55	10.2	108		7.8			Sample missing																	
Nov 4 1330	369	58	10.8	105	262	7.6	26 / 1.297	12 / 1.015	10 / 0.435	1.6 / 0.041	0 / 0.000	144 / 2.360		6.0 / 0.169			0.83				16	116	0	20		USGS
Dec 3 1100	210	49	10.8	94	277	7.8	29 / 1.45	13 / 1.07	10 / 0.44	1.1 / 0.03	0 / 0.000	161 / 2.64		6.5 / 0.18			0.55				15	126	0	0.8		USGS
																									median 23	
																									minimum .06	
*Lab pH																									maximum 620	

a Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and chromium (Cr), reported here as $\frac{0.0}{0.00}$ except as shown.

b Determined by addition of analysed constituents

c Gravimetric determination.

d Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by Calif. Dept of Public Health, Division of Laboratories.

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ANALYSES OF SURFACE WATER

NORTH COASTAL REGION

Date and time sampled	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH f	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm b	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity in ppm	Coliform d MPN/ml	Analyzed by e
							Mineral constituents in parts per million / equivalents per million																			
											RUSSIAN RIVER NEAR HEALDSBURG															
1957																										
1/7 1050	158	48	12.0	103	305	8.2	31 1.55	14 1.18	11 0.48	0.9 0.02	0 0.00	173 2.84		7.2 0.20			0.94				15	137	0	.5		USGS
2/4 1035	355	48	13.2	114	266	7.7	26 1.30	13 1.10	10 0.44	1.0 0.03	0 0.00	145 2.38		7.3 0.21			0.64				15	120	1	8		USGS
3/4 1100	3620	55	12.2	114	191	7.6	17 0.85	11 0.87	6.8 0.30	1.4 0.04	0 0.00	103 1.69		3.7 0.10			0.29				15	86	2	80		USGS
4/1 1320	1060	61	10.9	110	251	7.1	25 1.25	14 1.12	8.4 0.37	0.8 0.02	0 0.00	138 2.26		5.0 0.14			0.33				13	118	5	14		USGS
5/6 1020	760	63	9.0	93	243	7.1	25 1.25	13 1.05	7.8 0.34	0.8 0.02	0 0.00	138 2.26	12 0.25	5.0 0.14	0.5 0.01	0.2 0.01	0.28	18	Fe 0.01 Al 0.05 PO_4 0.10 Cu 0.02 Zn 0.02	151	13	115	2	3.1		USGS
6/3 1300	860	74	9.5	110	247	7.4	26 1.30	13 1.06	9.6 0.42	1.6 0.04	0 0.00	140 2.29		4.5 0.13			0.34				15	118	3	1		USGS
7/8 1005	185	74	8.4	97	275	8.4			9.5 0.41		0 0.00	157 2.57		5.6 0.16			0.54				14	124	0	1		USGS
8/5 1115	180	72	7.4	84	267	7.3			9.6 0.42		0 0.00	156 2.56		6.0 0.17			0.58				14	124	0	1		USGS
9/10 1030	140	70	8.4	93	258	7.8	24 1.20	15 1.24	8.7 0.38	1.4 0.04	0 0.00	156 2.56	2.9 0.06	5.5 0.16	0.2 0.00	0.2 0.01	0.54	18	PO_4 0.00 Al 0.05 Pb 0.01	153	13	122	0	2		USGS
10/14 1700	4240	62	7.8	79	169	7.3			6.1 0.27		0 0.00	87 1.43		3.7 0.10			0.27				16	72	1	80	Median 62	USGS
11/4 1030	680	55	9.3	87	259	7.3			8.7 0.38		0 0.00	146 2.39		5.5 0.16			0.34				14	120	0	3	Max. 7000	USGS
12/16 1115	2160	55	9.6	90	190	7.8			6.9 0.30		0 0.00	95 1.56		4.0 0.11			0.38				15	82		150	Min. 0.21	USGS

a Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and chromium (Cr), reported here as $\frac{0.0}{0.00}$ except as shown.

b Determined by addition of analyzed constituents.

c Gravimetric determination.

d Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by Calif. Dept. of Public Health, Division of Laboratories.

e Mineral analyses made by USGS, Quality of Water Branch (USGS), Pacific Chemical Consultant (PCC), Metropolitan Water District (MWD), Los Angeles Dept. of Water & Power (LADWP), City of Los Angeles Dept. of Pub Health (LADPH), Long Beach Dept. of Pub Health (LBDPH) or State Department of Water Resources (DWR), as indicated

f Field pH except when noted with *

ANALYSES OF SURFACE WATER

NORTH COASTAL REGION (1)

Date and time sampled PST	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH [f]	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity in ppm	Coliform[d] MPN/ml	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																			
1958																										USGS
											RUSSIAN RIVER NEAR HEALDSBURG															
1/13 1600	6,360	50	12.0	106	148	7.6	---	---	5.4 / 0.23	---	0 / 0.00	80 / 1.31	---	1.5 / 0.04	---	---	0.15 / ---	--		---	15	65	0	200		
2/3 0950	13,000	45	11.2	93	132	7.2	---	---	4.6 / 0.20	---	0 / 0.00	72 / 1.18	---	3.0 / 0.08	---	---	0.08 / ---	--		---	14	59	0	335	Maximum 7000.+ Minimum 0.62 Median 13.	
3/10 1000	1,920	53	11.0	101	245	8.3	---	---	7.5 / 0.33	---	0 / 0.00	138 / 2.26	---	4.5 / 0.13	---	---	0.19 / ---	--		---	13	112	0	45		
4/4 1225	16,100	52	10.8	98	137	8.1	---	---	5.0 / 0.22	---	0 / 0.00	80 / 1.31	---	3.0 / 0.08	---	---	0.08 / ---	--		---	15	62	0	600		
5/9 1335	734	65	9.2	97	273	8.5	28 / 1.40	14 / 1.18	8.6 / 0.37	1.7 / 0.04	0 / 0.00	154 / 2.52	12 / 0.25	5.0 / 0.14	0.3 / 0.00	0.0 / 0.00	0.17 / ----	19 / --	Al 0.08 Cu 0.01 / a PO_4 0.15	165[b]	12	129	3	5		
6/6 1320	450	69	9.0	99	260	8.0	---	---	8.3 / 0.36	---	0 / 0.00	148 / 2.43	---	3.8 / 0.11	---	---	0.30 / ---	--		---	13	121	0	6		
7/11 1325	210	75	7.0	82	281	7.5	---	---	8.6 / 0.37	---	0 / 0.00	162 / 2.66	---	6.2 / 0.17	---	---	0.4 / ---	--		---	13	128	0	2		
8/8 1320	175	75	9.0	105	276	8.3	---	---	8.5 / 0.37	---	0 / 0.00	156 / 2.56	---	5.5 / 0.16	---	---	0.5 / ---	--		---	13	126	0	4		
9/12 1310	170	69	8.8	97	262	8.2	26 / 1.30	14 / 1.14	7.4 / 0.32	1.2 / 0.03	0 / 0.00	148 / 2.43	7.7 / 0.16	7.0 / 0.20	0.5 / 0.01	0.0 / 0.00	0.8 / ---	13 / --	Zn 0.01 PO_4 0.00 / a	151[b]	11	122	1	11		
10/7 1130	257	66	9.8	104	245	8.1*	---	---	8.2 / 0.36	---	0 / 0.00	---	---	6.0 / 0.17	---	---	0.6 / ---	--		---	13	116	0	1		
11/10 1100	332	58	9.5	92	242	8.3	---	---	8.0 / 0.35	---	0 / 0.00	136 / 2.23	---	6.8 / 0.19	---	---	0.7 / ---	--		---	14	104	0	5		
12/5 0940	164	52	9.8	94	284	7.5	---	---	9.7 / 0.42	---	0 / 0.00	162 / 2.66	---	9.5 / 0.27	---	---	1.0 / ---	--		---	13	136	3	2		

a Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and hexavalent chromium (Cr^{+6}), reported here as $\frac{0.0}{0.00}$ except as shown.
b Determined by addition of analyzed constituents.
c Gravimetric determination.
d Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by Calif. Dept. of Public Health, Division of Laboratories, or United States Public Health Service.
e Mineral analyses made by USGS, Quality of Water Branch (USGS), United States Public Health Service (USPHS), San Bernardino County Flood Control District (SBCFCD), Metropolitan Water District (MWD), Los Angeles Dept. of Water & Power (LADWP), City of Los Angeles Dept. of Pub. Health (LADPH), Long Beach Dept. of Pub. Health (LBDPH), Terminal Testing Laboratories, Inc. (TTL), State Department of Water Resources (DWR), as indicated
f Field pH except when noted with *

ANALYSES OF SURFACE WATER

NORTH COASTAL REGION (NO. 1)

RUSSIAN RIVER NEAR HEALDSBURG

Date and time sampled P.S.T.	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen % Sat	Specific conductance (micromhos at 25°C)	pH[a]	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity in ppm	Coliform[h] MPN/ml	Analyzed by[i]
							Mineral constituents in parts per million / equivalents per million																			
1959																									Median 23.	USGS
1/7 0930	1,160	50	10.1	90	190	7.3	1.56[c]		6.9 / 0.30		0.0 / 0.00	75 / 1.23		7.5 / 0.21			0.2			112[e]	16	78	16	40	Maximum 2,100.	
2/6 0820	641	51	10.1	90	253	7.5	2.28[c]		8.2 / 0.36		0.0 / 0.00	130 / 2.13		5.5 / 0.16			0.06			149[e]	14	114	7	5	Minimum 0.13	
3/2 1415	1,280	58	9.5	92	248	7.5	2.28[c]		7.2 / 0.31		0.0 / 0.00	130 / 2.13		5.8 / 0.16			0.3			146[e]	12	114	7	20		
4/1 1330	947	61	9.1	92	207	7.5	1.92[c]		7.1 / 0.31		0.0 / 0.00	110 / 1.80		5.5 / 0.16			0.2			122[e]	14	96	6	40		
5/11 1610	185	77	9.0	107	282	7.9	25 / 1.25	16 / 1.35	8.4 / 0.37	1.4 / 0.04	0.0 / 0.00	159 / 2.61	8.6 / 0.18	7.0 / 0.20	1.5 / 0.02	0.1 / 0.01	0.5	13	Fe 0.02 Al 0.07[d] PO_4 0.05	160[f]	12	130	0	30		
6/11 1145	145	72	8.5	97	276	7.7	2.60[c]		8.8 / 0.38		0.0 / 0.00	158 / 2.59		7.0 / 0.20			0.5			163[e]	13	130	0	10		
7/1 1445	170	75	8.5	90	253	7.7	2.34[c]		8.8 / 0.38		0.0 / 0.00	146 / 2.39		4.8 / 0.14			0.4			149[e]	14	117	0	10		
8/12 1545	163	77	8.5	102	241	7.9	2.24[c]		8.7 / 0.38		0.0 / 0.00	141 / 2.31		4.5 / 0.13			0.6			142[e]	15	112	0	3		
9/4 0630	200	68	7.6	83	234	7.7	23 / 1.15	12 / 0.99	8.5 / 0.37	1.5 / 0.04	0.0 / 0.00	136 / 2.23	7.2 / 0.15	4.2 / 0.12	0.0 / 0.00	0.0 / 0.00	0.4	11	Fe 0.03 Al 0.02[d] PO_4 0.00 Cu 0.02	135[f]	15	107	0	3		
10/15 0900	313	63	8.0	83	224	7.5	2.06[c]		7.2 / 0.31		0.0 / 0.00	128 / 2.10		6.0 / 0.17			0.4			132[e]	13	103	0	8		
11/4 1615	313	61	8.3	84	344	7.5	2.84[c]		19 / 0.83		0.0 / 0.00	179 / 2.93		14 / 0.39			0.4			204[e]	23	142	0	5		
12/3 1530	337	54	10.6	98	227	7.9	2.10[c]		7.7 / 0.33		0.0 / 0.00	128 / 2.10		5.2 / 0.15			0.5			134[e]	14	105	0	3		

a Field pH.

b Laboratory pH.

c Sum of calcium and magnesium in epm.

d Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and hexavalent chromium (Cr^{+6}), reported here as $\frac{0.0}{0.00}$ except as shown.

e Derived from conductivity vs TDS curves.

f Determined by addition of analyzed constituents.

g Gravimetric determination.

h Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by California Department of Public Health, Division of Laboratories, or United States Public Health Service.

i Mineral analyses made by United States Geological Survey, Quality of Water Branch (USGS); United States Department of the Interior, Bureau of Reclamation (USBR); United States Public Health Service (USPHS);; San Bernardino County Flood Control District (SBCFCD); Metropolitan Water District of Southern California (MWD); Los Angeles Department of Water and Power (LADWP); City of Los Angeles, Department of Public Health (LADPH); City of Long Beach, Department of Public Health (LBDPH); Terminal Testing Laboratories, Inc. (TTL); or California Department of Water Resources (DWR); as indicated.

ANALYSES OF SURFACE WATER

NORTH COASTAL REGION (NO. 1)

RUSSIAN RIVER NEAR HEALDSBURG

Date and time sampled PST	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH[a]	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Per cent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity in ppm	Coliform[h] MPN/ml	Analyzed by[i]
							Mineral constituents in parts per million / equivalents per million																			
1960																										USGS
1/14 1330	300	47	11.2	95	253	7.3	2.10[c]		8.7 / 0.38		0.0 / 0.00	130 / 2.13		6.0 / 0.17			0.4			149[e]	14	120	13	100	Median 6.2	
2/4 1000	2,440	50	10.1	89	180	7.3	1.66[c]		6.4 / 0.28		0.0 / 0.00	91 / 1.49		8.0 / 0.23			0.1			106[e]	14	83	8	70	Maximum 2,400.	
3/10 1605	3,920	54	10.3	96	182	7.3	1.60[c]		5.3 / 0.23		[illegible]	92 / 1.51		5.5 / 0.16			0.2			107[e]	13	80	5	500	Minimum 0.06	
4/14 1540	1,030	62	9.8	100	214	7.8	1.96[c]		6.1 / 0.27		0.0 / 0.00	116 / 1.90		6.0 / 0.17			0.3			126[e]	12	98	3	25		
5/9 1515	630	72	10.4	119	233	7.0	23 / 1.15	13 / 1.03	7.3 / 0.32	[illegible]	[illegible]	135 / 2.21	11 / 0.23	5.0 / 0.14	1.1 / 0.02	0.0 / 0.00	0.3	15	Fe 0.02 Al 0.06 PO_4 0.05[d] Cu 0.01	144[f]	13	109	0	12		
6/15 0720	205 (est.)	76	7.7	91	257	7.9	2.44[c]		7.5 / 0.33		0.0 / 0.00	149 / 2.44		6.8 / 0.19			0.5			152[e]	12	122	0	2		
7/14 0845	200	70	7.5	84	246	7.5	2.36[c]		7.4 / 0.32		[illegible] / .00	146 / 2.39		4.0 / 0.11			0.4			145[e]	12	118	0	4		
8/4 1345	210	73	8.8	101	234	7.7	2.07[c]		8.0 / 0.35		[illegible]	134 / 2.20		4.8 / 0.14			0.3			138[e]	14	103	0	2		
9/14 1520	195	71	9.6	97	248	7.9	23 / 1.15	13 / 1.11	9.8 / 0.43	[illegible]	[illegible] / 0.00	143 / 2.34	[illegible] / 0.19	4.8 / 0.14	0.0 / 0.00	0.1 / 0.01	0.5	17	Al 0.07 PO_4 0.00[d]	148[f]	16	113	0	10		
10/13 0725	227	61	9.6	87	234	[illegible]	23 / 1.15	[illegible] / 0.97	[illegible] / 0.33		[illegible]	130 / 2.13		5.5 / 0.16			0.4			138[e]	13	106	0	4		
11/2 1615	[illegible]	58	9.9	[illegible]	227	[illegible]	2.03[c]		7.7 / .33		[illegible]	124 / 2.03		10 / 0.28			0.4			134[e]	14	101	0	2		
12/7 1510	962	51	10.5	94	258	[illegible]	2.17[c]		[illegible]		[illegible] / 0.00	116 / 1.90		5.2 / 0.15			0.4			152[e]	15	108	13	18		

a Field pH

b Laboratory pH.

c Sum of calcium and magnesium in epm.

d Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and hexavalent chromium (Cr^{+6}), reported here as $\frac{0.0}{0.00}$ except as shown.

e Derived from conductivity vs TDS curves

f Determined by addition of analyzed constituents.

g Gravimetric determination.

h Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by California Department of Public Health, Division of Laboratories, or United States Public Health Service.

i Mineral analyses made by United States Geological Survey, Quality of Water Branch (USGS); United States Department of the Interior, Bureau of Reclamation (USBR); United States Public Health Service (USPHS); San Bernardino County Flood Control District (SBCFCD), Metropolitan Water District of Southern California (MWD); Los Angeles Department of Water and Power (LADWP); City of Los Angeles, Department of Public Health (LADPH); City of Long Beach, Department of Public Health (LBDPH), Terminal Testing Laboratories, Inc (TTL); or California Department of Water Resources (DWR); as indicated.

ANALYSES OF SURFACE WATER

NORTH COASTAL REGION (1)

RUSSIAN RIVER NEAR HEALDSBURG (STA. 9)

Date and time sampled P.S.T.	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH[a]	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity in ppm	Coliform[h] MPN/ml	Analyzed by[i]
							Mineral constituents in parts per million / equivalents per million																			
1961																										USGS
1/4 1525	722	47	11.9	101	247	7.9	2.32[c]		8.0 / 0.35		0.0 / 0.00	135 / 2.21		5.0 / 0.14			0.4			146[e]	13	116	5	4	Median 6.2	
2/17 1120	3,260	51	10.6	95	193	7.5	1.76[c]		5.6 / 0.24		0.0 / 0.00	102 / 1.67		3.0 / 0.08			0.2			114[e]	12	88	4	500	Maximum 2,400.	
3/1 1200	685	58	10.0	97	280	7.5	2.64[c]		8.5 / 0.37		0.0 / 0.00	148 / 2.43		4.2 / 0.12			0.3			165[e]	12	132	11	30	Minimum 0.23	
4/13 0800	896	56	9.8	93	246	7.9	2.38[c]		8.3 / 0.36		0.0 / 0.00	135 / 2.21		4.5 / 0.13			0.3			145[e]	13	119	8	13		
5/3 1520	752	64	10.5	109	237	7.9	23 / 1.15	12 / 1.00	9.5 / 0.41	1.4 / 0.04	1 / 0.03	130 / 2.13	11 / 0.23	3.8 / 0.11	0.8 / 0.01	0.2 / 0.01	0.3	13	Fe 0.02 Al 0.03 [d] Cu 0.01 Zn 0.01 Tot. Alk. 132	140[f]	16	108	0	4		
6/1 1220	415	65	8.0	84	247	7.7	2.28[c]		8.5 / 0.37		1 / 0.03	134 / 2.20		5.5 / 0.16			0.3		Tot. Alk. 136	146[e]	14	114	2	2		
7/7 1415	325 (est.)	75	8.0	94	229	8.0	2.10[c]		7.5 / 0.33		0.0 / 0.00	128 / 2.10		3.3 / 0.09			0.2			135[g]	14	105	0	5		
8/2 1240	300	75	8.3	97	220	8.1	2.08[c]		6.9 / 0.30		0.0 / 0.00	125 / 2.05		4.6 / 0.13			0.4			130[e]	13	104	2	2		
9/6 1330	390	73	7.7	89	215	7.9	24 / 1.20	9.2 / 0.76	7.0 / 0.30	1.0 / 0.03	0.0 / 0.00	120 / 1.97	7.0 / 0.15	2.2 / 0.06	0.8 / 0.01	0.1 / 0.01	0.4	12	Fe 0.10 PO_4 0.05 [d] Zn 0.02	123[f]	13	98	0	6		
10/3 1305	352	71	8.6	97	212	8.1	1.96[c]		6.4 / 0.28		0.0 / 0.00	119 / 1.95		4.0 / 0.11			0.3			125[e]	12	98	0	5		
11/10 1340	217	57	9.8	94	235	7.9	2.10[c]		7.9 / 0.34		2 / 0.07	129 / 2.11		3.5 / 0.10			0.3		Tot. Alk. 133	139[e]	14	105	0	5		
12/11 1330	481	51	10.0	89	277	7.4	2.58[c]		8.1 / 0.35		0.0 / 0.00	144 / 2.36		6.8 / 0.19			0.5			163[e]	12	129	11	9		

a Field pH.

b Laboratory pH.

c Sum of calcium and magnesium in epm.

d Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and hexavalent chromium (Cr^{+6}), reported here as $\frac{0.0}{0.00}$ except as shown.

e Derived from conductivity vs TDS curves.

f Determined by addition of analyzed constituents

g Gravimetric determination.

h Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by California Department of Public Health, Division of Laboratories, or United States Public Health Service.

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ANALYSES OF SURFACE WATER

NORTH COASTAL REGION (1)

RUSSIAN RIVER NEAR HEALDSBURG

Date and time sampled P.S.T.	Discharge in cfs	Temp in °F	Dissolved oxygen (a = 1.00) ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH [a]	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity in ppm	Coliform[h] MPN/ml	Analyzed by[i]
							Mineral constituents in parts per million / equivalents per million																			
1962																										
1/8 1250	268	57	10.9	105	279	7.5	2.60[c]		9.1 / 0.40		1 / 0.03	147 / 2.41		7.6 / 0.21			0.4		Total Alkalinity: 148	165[e]	13	130	9	1	Median 2.3	USGS
2/13 1340	30200	52	9.7	88	90	7.2	0.86[c]		4.0 / 0.17		0 / 0.00	46 / 0.75		2.0 / 0.06			0.0			53[e]	17	43	5	2800	Max. 2400	
3/6 1230	18600	48	10.8	93	105	7.7	0.96[c]		4.0 / 0.17		0 / 0.00	55 / 0.90		1.5 / 0.04			0.1			62[e]	15	48	3	240	Min. 0.06	
4/10 1245	752	65	10.0	105	286	8.3	2.68[c]		9.9 / 0.43		0 / 0.00	158 / 2.59		6.0 / 0.17			0.3			168[e]	14	134	4	2		
5/8 1120	284	64	11.0	114	281	7.9	28 / 1.40	15 / 1.20	9.8 / 0.43	1.2 / 0.03	0 / 0.00	153 / 2.51	15 / 0.31	4.5 / 0.13	2.1 / 0.03	0.0 / 0.00	0.3	15	PO_4 0.05	166[f]	14	130	5	8		
6/7 1145	180	73	10.7	123	281	8.2	2.66[c]		8.9 / 0.39		0 / 0.00	156 / 2.56		5.5 / 0.16			0.3			166[e]	13	133	5	3		
7/10 1800	151	74	12.0	139	276	8.4	2.54[c]		9.8 / 0.43		0 / 0.00	150 / 2.46		6.6 / 0.19			0.4			162[e]	14	127	4	5		
8/7 1235	195	72	8.7	99	255	8.2	2.28[c]		9.7 / 0.42		0 / 0.00	146 / 2.39		6.2 / 0.17			0.4			150[e]	16	114	0	5		
9/11 1205	200	71	11.5	129	243	6.7	26 / 1.30	12 / 0.96	8.1 / 0.35	0.8 / 0.02	4 / 0.13	133 / 2.18	10 / 0.21	4.0 / 0.11	0.3 / 0.00	0.0 / 0.00	0.4	12	PO_4 0.10 Total Alkalinity: 141	151[g]	13	113	0	2		

a Field pH

b Laboratory pH

c Sum of calcium and magnesium in epm

d Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and hexavalent chromium (Cr^{+6}), reported here as $\frac{0.0}{0.00}$ except as shown.

e Derived from conductivity vs TDS curves f = 0.590

f Determined by addition of analyzed constituents.

g Gravimetric determination

h Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by California Department of Public Health, Division of Laboratories, or United States Public Health Service

i Mineral analyses made by United States Geological Survey, Quality of Water Branch (USGS), United States Department of the Interior, Bureau of Reclamation (USBR), United States Public Health Service (USPHS), San Bernardino County Flood Control District (SBCFCD), Metropolitan Water District of Southern California (MWD), Los Angeles Department of Water and Power (LADWP), City of Los Angeles, Department of Public Health (LADPH); City of Long Beach, Department of Public Health (LBDPH), Terminal Testing Laboratories, Inc. (TTL), or California Department of Water Resources (DWR), as indicated.

ANALYSES OF SURFACE WATER

NORTH COASTAL REGION (NO. 1)

Date and time sampled P.S.T.	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH a/b	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO₃)	Bicarbonate (HCO₃)	Sulfate (SO₄)	Chloride (Cl)	Nitrate (NO₃)	Fluoride (F)	Boron (B)	Silica (SiO₂)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as CaCO₃ Total ppm	Hardness as CaCO₃ N.C. ppm	Turbidity in ppm	Coliform MPN/ml	Analyzed by i
							Mineral constituents in parts per million / equivalents per million																			
RUSSIAN RIVER NEAR HEALDSBURG																										
10-8-62 1440	189	70	9.7	108	242	7.8 / 8.0		2.25[c]	9.0 / 0.39		0 / 0.00	144 / 2.36		7.4 / 0.21			0.3			144[e]	15	112	0	3	62. / 230.	USGS
11-15-62 1445	440	57	13.0	125	237	8.3 / 8.1		2.14[c]	8.1 / 0.35		0 / 0.00	136 / 2.23		4.8 / 0.14			0.5			141[e]	14	107	0	4	2. / 2.1	
12-10-62 1055	388	52	9.8	89	252	7.5 / 8.1		2.32[c]	8.5 / 0.37		0 / 0.00	143 / 2.34		4.9 / 0.14			0.4			149[e]	14	116	0	20	23. / 2.3	
1-2-63 1205	486	52	10.4	94	286	7.7 / 8.1		2.68[c]	9.2 / 0.40		0 / 0.00	161 / 2.64		8.0 / 0.23			0.3			170[e]	13	134	2	5	6.2 / 23.	
2-11-63 1255	2,670	60	10.1	101	202	7.6 / 7.7		1.92[c]	6.5 / 0.28		0 / 0.00	115 / 1.88		3.2 / 0.09			0.3			120[e]	13	96	2	50	7,000. / 230.	
3-11-63 1205	891	59	11.5	113	255	8.0 / 7.8		2.33[c]	7.5 / 0.33		0 / 0.00	144 / 2.36		5.2 / 0.15			0.3			151[e]	12	117	0	20	50. / 62.	
4-11-63 1545	5,580	54	11.8	110	175	7.8 / 8.0		1.59[c]	5.2 / 0.23		0 / 0.00	98 / 1.61		3.5 / 0.10			0.0			104[e]	13	79	0	160	230. / 230.	
5-6-63 1145	1,520	63	10.1	104	235	7.8 / 7.9	22 / 1.10	14 / 1.12	6.8 / 0.30	1.2 / 0.03	0 / 0.00	137 / 2.25	11 / 0.23	3.8 / 0.11	2.1 / 0.03	0.2 / 0.01	0.2	21	PO_4 = 0.10	147[g]	12	111	0	5	6.2 / 230.	
6-11-63 1140	360	70	8.9	99	287	8. / 8.2		2.76[c]	8.3 / 0.36		0 / 0.00	168 / 2.75		3.0 / 0.08			0.4			170[e]	12	138	0	2	2.3 / 2.3	
7-9-63 1315	220	79	10.0	123	288	8.2 / 8.0		2.74[c]	9.2 / 0.40		0 / 0.00	168 / 2.75		5.1 / 0.14			0.5			171[e]	13	137	0	5	1.2 / .6	
8-6-63 1110	160	73	9.8	113	287	8. / 8.0		2.66[c]	9.2 / 0.40		0 / 0.00	160 / 2.62		7.6 / 0.21			0.2			170[e]	13	133	2	2	23. / 6.2	
9-11-63 1530	220	74	9.1	106	245	8.0 / 8.2	25 / 1.25	13 / 1.03	7.4 / 0.32	1.0 / 0.03	0 / 0.00	141 / 2.31	9.0 / 0.19	5.8 / 0.16	0.7 / 0.01	0.1 / 0.01	0.3	15	As = 0.00 ABS = 0.0 PO_4 = 0.05	138[g]	12	114	0	2	2.1 / .23	

a Field pH.

b Laboratory pH.

c Sum of calcium and magnesium in epm.

d Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and hexavalent chromium (Cr^{+6}), reported here as $\frac{0.0}{0.00}$ except as shown.

e Derived from conductivity vs TDS curves.

f Determined by addition of analyzed constituents.

g Gravimetric determination.

h Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by California Department of Public Health, Division of Laboratories, or United States Public Health Service

i Mineral analyses made by United States Geological Survey, Quality of Water Branch (USGS); United States Department of the Interior, Bureau of Reclamation (USBR); United States Public Health Service (USPHS); San Bernardino County Flood Control District (SBCFCD); Metropolitan Water District of Southern California (MWD); Los Angeles Department of Water and Power (LADWP); City of Los Angeles, Department of Public Health (LADPH); City of Long Beach, Department of Public Health (LBDPH), Terminal Testing Laboratories, Inc. (TTL); or California Department of Water Resources (DWR); as indicated.

ANALYSES OF SURFACE WATER

NORTH COASTAL REGION (NO. 1)

Date and time sampled P.S.T.	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH a/b	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity in ppm	Coliform[h] MPN/ml	Analyzed by[i]
RUSSIAN RIVER NEAR HEALDSBURG																										
10-11-63 0920	260	62	B.2	84	237	7.7 / 7.7		2.20[c]	7.0 / 0.30		0 / 0.00	137 / 2.25		6.9 / 0.19			0.2				12	110	0	8	62. / 62.	USGS
11-13-63 1410	605	59	9.8	97	245	7.8 / 8.0		2.22[c]	7.4 / 0.32		0 / 0.00	133 / 2.18		6.8 / 0.19			0.4				13	111	2	15	62. / 62.	
12-13-63 1210	418	47	11.8	99	292	7.2 / 8.1		2.74[c]	9.2 / 0.40		0 / 0.00	162 / 2.66		7.0 / 0.20			0.4				13	137	4	2	6.2 / 6.2	
1-8-64 1215	1,560	50	11.9	105	192	7.3 / 8.6		1.72[c]	7.3 / 0.32		4 / 0.13	102 / 1.67		5.0 / 0.14			0.3				16	86	0	30	230. / 62.	
2-5-64 1330	800	54	10.8	100	263	7.9 / 8.0		2.48[c]	8.8 / 0.38		0 / 0.00	146 / 2.39		4.5 / 0.13			0.3				13	124	4	10	6.2 / 23.	
3-11-64 1530	544	51	11.4	102	258	8.0 / 8.0		2.36[c]	8.5 / 0.37		0 / 0.00	140 / 2.29		5.5 / 0.16			0.3				14	118	3	3	23. / 2.3	
4-15-64 1210	313	69	10.9	120	288	8.2 / 8.4		2.72[c]	9.5 / 0.41		2 / 0.07	158 / 2.59		6.5 / 0.18			0.4				13	136	3	2	2.3 / 23.	
5-12-64 1130	166	68	9.5	103	309	8.0 / 7.9	33 / 1.65	15 / 1.23	9.2 / 0.40	1.0 / 0.03	0 / 0.00	171 / 2.80	15 / 0.31	8.5 / 0.24	1.0 / 0.02	0.2 / 0.01	0.5	12	As = 0.00 ABS = 0.0 PO_4 = 0.00	169	12	144	4	1	23. / 13.	
6-3-64 1110	150	70	9.7	108	310	8.4 / 8.3		2.88[c]	7.4 / 0.32		2 / 0.07	168 / 2.75		8.0 / 0.23			0.5				10	144	3	1	23. / 13.	
7-15-64 1045	195	78	8.7	105	262	7.8 / 8.3		2.48[c]	8.8 / 0.38		4 / 0.13	140 / 2.29		4.4 / 0.12			0.5				13	124	3	2	.62 / .62	
8-11-64 1200	182	74	8.7	101	258	8.2 / 8.2		2.38[c]	9.1 / 0.40		0 / 0.00	148 / 2.43		4.5 / 0.13			0.6				14	119	0	2	23. / 23.	
9-2-64 1215	180	70	8.8	98	257	8.1 / 7.9	27 / 1.35	13 / 1.03	8.8 / 0.38	1.0 / 0.03	0 / 0.00	145 / 2.38	11 / 0.23	4.8 / 0.14	0.6 / 0.01		0.5	12	As = 0.00 ABS = 0.1 PO_4 = 0.00	142	14	119	0	1	6.2 / 6.2	

a Field pH.

b Laboratory pH.

c Sum of calcium and magnesium in epm.

d Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and hexavalent chromium (Cr^{+6}), reported here as $\frac{0.0}{0.00}$ except as shown.

e Derived from conductivity vs TDS curves.

f Determined by addition of analyzed constituents.

g Gravimetric determination.

h Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by California Department of Public Health, Division of Laboratories, or United States Public Health Service.

i Mineral analyses made by United States Geological Survey, Quality of Water Branch (USGS); United States Department of the Interior, Bureau of Reclamation (USBR); United States Public Health Service (USPHS), San Bernardino County Flood Control District (SBCFCD); Metropolitan Water District of Southern California (MWD); Los Angeles Department of Water and Power (LADWP); City of Los Angeles, Department of Public Health (LADPH); City of Long Beach, Department of Public Health (LBDPH); Terminal Testing Laboratories, Inc. (TTL); or California Department of Water Resources (DWR); as indicated.

ANALYSES OF SURFACE WATER

Date and time sampled P.S.T	Discharge in cfs	Temp in °F	Dissolved oxygen		Specific conductance (micromhos at 25°C)	pH a/b	Mineral constituents in parts per million / equivalents per million													Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$		Turbidity a/b	Coliform[c] MPN/ml	Analyzed by [d]
			ppm	%Sat			Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents			Total ppm	N C ppm			
											NORTH COASTAL REGION (NO. 1)															
											RUSSIAN RIVER NEAR HEALDSBURG															
10-16-64 0910	172	63	9.2	95	257	7.9/8.2		2.34[e]	9.2/0.40		0/0.00	148/2.43		4.9/0.14			0.5				15	117	0	/1	13./23.	USGS
11-10-64 0930	5,420	52	9.8	89	152	7.4/7.2		1.28[e]	5.5/0.24		0/0.00	67/1.10		4.5/0.13			0.2				16	64	9	/6000	2,100./7,000.	
12-2-64 1415	1,430	55	9.6	90	179	7.4/7.7		1.54[e]	6.7/0.29		0/0.00	88/1.44		3.5/0.10			0.2				16	77	5	/50	230./620.	
1-6-65 1135	29,200	54	10.4	97	112	7.6/7.7		0.96[e]	4.4/0.19		0/0.00	57/0.93		1.9/0.05			0.2				17	48	1	/1500	620./1,300.	
2-3-65 1125	2,790	45	13.3	110	186	8.0/8.1		1.68[e]	6.1/0.27		0/0.00	97/1.59		3.0/0.08			0.2				14	84	4	/300	23.	
3-12-65 1115	548	58	9.6	93	278	7.8/8.2		2.60[e]	8.6/0.37		0/0.00	151/2.47		5.2/0.15			0.4				12	130	6	/20	13./23.	
4-14-65 1230	1,880	54	10.9	101	222	7.8/7.5		2.02[e]	7.8/0.34		0/0.00	118/1.93		3.9/0.11			0.1				14	101	4	/80	62./62.	
5-12-65 1030	755	67	10.0	108	252	8.1/8.2	28/1.40	11/0.92	7.4/0.32	1.3/0.03	0/0.00	137/2.25	14/0.29	4.2/0.12	2.4/0.04		0.3	14	As = 0.00 ABS = 0.1 PO_4 = 0.05	153	12	116	4	/30	23./23.	

a Field determination.

b Laboratory analysis.

c Analyzed by California Department of Public Health, Division of Laboratories.

d Mineral analyses made by United States Geological Survey, Water Resources Division (USGS) or California Department of Water Resources (DWR) as indicated.

e Sum of calcium and magnesium in epm.

ANALYSES OF SURFACE WATER

Date and time sampled P.S.T	Discharge in cfs	Temp in °F	Dissolved oxygen		Specific conductance (micromhos at 25°C)	pH	Mineral constituents in parts per million / equivalents per million													Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$		Turbidity	Coliform[c] MPN/ml	Analyzed by[d]
			ppm	% Sat		a / b	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents			Total ppm	N C ppm	a / b		
NORTH COASTAL REGION (NO. 1)																										
RUSSIAN RIVER NEAR HEALDSBURG (CONT.)																										
6-2-65 1300	375	65	8.5	90	256	8.0 / 8.5		— / 2.42[e]	8.1 / 0.35		4 / 0.13	134 / 2.20		3.9 / 0.11			0.4									

a Field determination.

b Laboratory analysis.

c Analyzed by California Department of Public Health, Division of Laboratories.

d Mineral analyses made by United States Geological Survey, Water Resources Division (USGS) or California Department of Water Resources (DWR) as indicated.

e Sum of calcium and magnesium in epm.

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

FRANZ CREEK (STATION 15)
9N/8W-20L

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents [b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hach / Hellige	Analyzed by[e]
12-15-65 1625	4	44.5	11.8	96.8	212	7.3 / 8.0	1.42[a]				0 / 0.00	85 / 1.39		11 / 0.31	3.6 / 0.06				PO_4 = 0.21			71	1	< 5	DWR
1-19-66 1400	8	47	11.3	95.9	167	7.9 / 7.8	1.38[a]				0 / 0.00	64 / 1.05		8.1 / 0.23	4.8 / 0.08				PO_4 = 0.20			69	17	17	DWR
3-2-66 1305	10	50.5	12.6	112	138	8.5 / 8.1	14	1.9			0 / 0.00	62 / 1.02		5.4 / 0.15	1.8 / 0.03		0.0			122		43	0	15	DWR
4-14-66 1330	4	60	8.2	81.9	280	7.1	1.28[a]					128		18 / 0.51	1.8 / 0.03				PO_4 = 0.96 (Ortho)			105		8.6	DWR
5-9-66 1430	1	63	8.3	85.8	200	7.5						116		6.7 / 0.19	0.7 / 0.01				PO_4 = 0.20 (Ortho)					< 5 / 2.5	DWR
6-9-66 1115	1	69	7.3	80.6	260	7.3	1.64[a]					134		7.5 / 0.21	0.7 / 0.01				PO_4 = 0.19 (Ortho)			82		< 5 / 1.2	DWR
7-18-66	Dry																								
8-16-66	Dry																								

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hach turbidity in Jackson Turbidity Units using Hach Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

MAACAMA CREEK (STATION 16)
9N/8W-8J

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen % Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents[b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hach / Hellige	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																		
7-7-65 0800	6.1	65	8.5	89.8	252	8.1 / 8.3	19 / 0.95	19 / 1.59	6.8 / 0.30	1.3 / 0.03	0 / 0.00	158 / 2.59	7.7 / 0.16	4.8 / 0.14	0.4 / 0.01	0.1 / 0.00	0.0			150	10	127	0	< 5	DWR
9-29-65 0950	1.5	59.5	9.0	89.4	285	7.8 / 8.5	2.80[c]				6 / 0.20	158 / 2.59		4.0 / 0.11	0.4 / 0.01				PO_4 = 0.21			140	1	< 5	DWR
10-28-65 1020	0.8	58	9.1	88.8	280	8.0	24.0 / 1.20	18.2 / 1.50			0 / 0.00	165 / 2.70										135	0	< 5	Field Determination
12-15-65 1600	19	45	12.1	99.9	265	8.3 / 8.3	2.52[c]				0 / 0.00	144 / 2.36		6.3 / 0.18	2.1 / 0.03				PO_4 = 0.07			126	8	< 5	DWR
1-19-66 1330	64	47	12.0	102	237	8.3 / 8.3	2.24[c]				0 / 0.00	126 / 2.06		5.2 / 0.15	2.0 / 0.03				PO_4 = 0.05			112	9	< 5	DWR
3-2-66 1330	90	49	12.0	105	216	8.5 / 8.4	22	11			3 / 0.10	121 / 1.98		3.0 / 0.08	0.8 / 0.01		0.0			130		101	2	< 5	DWR
4-14-66 1200	65	61	11.0	111	235	8.5	2.30[c]					146		2.7 / 0.08	0.6 / 0.01				PO_4 = 0.05 (Ortho)			115		2.5	DWR
5-9-66 1210	16	61	10.7	108	250	8.5						159		3.4 / 0.10	0.4 / 0.01				PO_4 = 0.05 (Ortho)					< 5 / 1	DWR
6-9-66 1045	7.1	67	10.2	110	270	8.3	2.00[c]					171		4.1 / 0.12	0.6 / 0.01				PO_4 = 0.05 (Ortho)			100		< 5 / 0.7	DWR
7-18-66 1600	2.0	76	8.5	100	270	8.3						177												< 5 / 0.1	Field Determination
8-16-66 1600	0.8	77	9.3	111	260	8.5						177		4.8 / 0.14	0.6 / 0.01				PO_4 = 0.22 (Ortho) Fe = 0.03 Mn = 0.01	159				< 5 / 0.25	DWR

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hach turbidity in Jackson Turbidity Units using Hach Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

SAUSAL CREEK (STATION 17)
10N/9W-36L

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents[b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hoch / Hellige	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																		
12-15-65 1535	1.5	47.5	10.8	92.3	300	8.3 / 8.4	2.82[c]				4 / 0.13	151 / 2.47		6.0 / 0.17	0.5 / 0.01				PO_4 = 0.05			141	11	< 5	DWR
1-19-66 1300	4	48	12.0	103	261	8.3 / 8.3	2.50[c]				0 / 0.00	143 / 2.34		5.0 / 0.14	1.2 / 0.02				PO_4 = 0.04			125	8	< 5	DWR
3-2-66 1400	4	51	11.9	107	247	8.5 / 8.6	25	12			8 / 0.27	128 / 2.10		3.4 / 0.10	1.2 / 0.02		0.2			140		110	5	< 5	DWR
4-14-66 1140	3	66	10.8	116	290	8.4	2.92[c]					171		2.9 / 0.08	0.3 / 0.00				PO_4 = 0.06 (Ortho)			146		3	DWR
5-9-66 1350	1/4	62	6.2	63.4	340	7.1						195		5.5 / 0.16	20 / 0.32				PO_4 = 0.07 (Ortho)					< 5 / 2	DWR
6-9-66	Dry																								
7-18-66	Dry																								
8-16-66	Dry																								

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hoch turbidity in Jackson Turbidity Units using Hoch Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

RUSSIAN RIVER AT CLOVERDALE (STATION 18)
11N/11W-7R

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents[b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hach / Hellige	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																		
6-8-66 0840		64			253	8.1 / 8.5	28 / 1.40	11 / 0.92	8.4 / 0.36	1.3 / 0.03	6 / 0.20	133 / 2.18	15 / 0.31	3.5 / 0.10	2.4 / 0.04		0.5			135		116	4		DWR
7-19-66 1630		79	10.1	124	220	8.8 / 8.3					0 / 0.00	113 / 1.85			1.1 / 0.02		0.3							30 / 5.8	DWR
8-17-66 1730		79	8.9	109	200	8.5					12	134		4.2 / 0.12	1.0 / 0.02		0.3		PO_4 = 0.06 (Ortho) Fe = 0.56 Mn = 0.00	113				19 / 5.7	DWR

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hach turbidity in Jackson Turbidity Units using Hach Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

BIG SULPHUR CREEK-NEAR CLOVERDALE (STATION 19)
11N/10W-4N

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen % Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents [b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hoch / Hellige	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																		
7-7-65 0905	16	67.5	10.2	111	419	— / 8.6	41 / 2.04	22 / 1.80	11 / 0.48	1.5 / 0.04	10 / 0.33	164 / 2.69	54 / 1.12	3.9 / 0.11	8.3 / 0.13	0.1	1.4		PO_4 = 0.02 Fe = 0.10 Color = 0	234	11	192	40	< 5	DWR
9-28-65 1245	6.4	72	10.4	119	490	8.6 / 8.5	4.88[c]				9 / 0.30	158 / 2.59		4.2 / 0.12	20 / 0.32				PO_4 = 0.06			244	100	< 5	DWR
10-26-65 1400	5.4	69	10.0	110	520	8.7	56 / 2.80	24.3 / 2.00			12 / 0.20	159 / 2.61										240	100	< 5	DWR
12-15-65 1250	40	45	12.2	101	375	8.3 / 8.2	3.56[c]				0 / 0.00	165 / 2.70		4.6 / 0.13	11 / 0.18		1.0		PO_4 = 0.05			178	43	< 5	DWR
1-19-66 1000	155	43	12.7	102	302	8.4 / 8.1	2.92[c]				0 / 0.00	145 / 2.38		4.2 / 0.12	5.2 / 0.08		0.3		PO_4 = 0.05			146	27	7	DWR
3-2-66 0850	190	45	12.6	104	258	8.5 / 8.5	26	12			6 / 0.20	130 / 2.13	18 / 0.37	2.0 / 0.06	2.5 / 0.04		0.2			145		116	0	6	DWR
4-14-66 0935	86	59	11.0	109	280	8.4	2.72[c]					171		1.8 / 0.05	4.3 / 0.07		0.4		PO_4 = 0.06 (Ortho)			136		6.8	DWR
5-10-66 1040	42	59	10.2	101	330	8.5	2.98[c]					189		2.0 / 0.06	10 / 0.16		0.8		PO_4 = 0.05 (Ortho)			149		< 5 / 2.0	DWR
6-8-66 1520	22	73	9.0	104	380	8.9	3.16[c]					195		2.0 / 0.06	12 / 0.19		1.3		PO_4 = 0.03 (Ortho)			158		< 5 / 0.5	DWR
7-19-66 1120	7.7	78	10.2	128	420	8.9 / 8.6					8.4 / 0.27	155 / 2.54			17 / 0.27		1.8							< 5 / 0.3	DWR
8-17-66 1045	4.2	78	9.9	120	440	8.7						195		4.5 / 0.13	15 / 0.24		2.3		PO_4 = 0.04 (Ortho) Fe = 0.00 Mn = 0.01	300				< 5 / 0.2	DWR

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hoch turbidity in Jackson Turbidity units using Hoch Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

LITTLE SULPHUR CREEK (STATION 20)
11N/9W-25P

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents[b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hoch / Hellige	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																		
9-28-65 1425	2.5	61	9.1	92.0	260	7.9 / 8.5	/ 2.56[c]				4 / 0.13	146 / 2.39		1.7 / 0.05	0.3 / 0.00				PO_4 = 0.03			128	8	< 5	DWR
10-29-65 0830	3/4	52	9.4	85.2	260	8.1 /	28.1 / 1.40	14.6 / 1.20				159 / 2.60										130	0	< 5	Field Determination
12-15-65 1455	3	38.5	12.5	94.1	270	7.9 / 8.4	/ 2.74[c]				3 / 0.10	155 / 2.54		4.0 / 0.11	0.2 / 0.00		0.1 /		PO_4 = 0.03			137	5	< 5	DWR
1-19-66 1210	12	43	12.2	98.0	225	8.3 / 8.2	/ 2.26[c]				0 / 0.00	129 / 2.11		2.9 / 0.08	0.4 / 0.06				PO_4 = 0.02			113	7	< 5	DWR
3-2-66 1045	15	41.5	12.4	97.5	190	8.3 / 8.5	16 /	13 /			6 / 0.20	106 / 1.74		1.2 / 0.03	0.3 / 0.00		0.1 /			108		93	0	< 5	DWR
4-13-66 0955	10	50	11.4	100.7	180	8.1 /	/ 1.88[c]					120 /		1.7 / 0.05	0.0 / 0.00		0.0 /					94		3.2 /	DWR
5-10-66 0850	5	56	10.2	97.2	260	8.3 /	/ 2.34[c]					116 /		1.5 / 0.04	0.3 / 0.00		0.0 /		PO_4 = 0.02 (Ortho)			117		< 5 / 1.1	DWR
6-8-66 1715	4	69	8.8	97.2	290	8.5 /	/ 2.60[c]					195 /		1.7 / 0.05	0.6 / 0.01		0.0 /		PO_4 = 0.02 (Ortho)			130		< 5 / 0.7	DWR
7-19-66 0850	1	67	9.2	99.4	260	8.1 / 8.4					4 / 0.13	156 / 2.56			0.4 / 0.01		0.0 /							< 5 / 0.3	DWR
8-17-66 0840	2	68	8.4	91.8	240	7.9 /						171 /		1.8 / 0.05	0.1 / 0.00		0.0 /		PO_4 = 0.06 (Ortho) Fe = 0.02 Mn = 0.04	148				< 5 / 0.25	DWR

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hoch turbidity in Jackson Turbidity Units using Hoch Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

BIG SULPHUR CREEK AT GEYSERS ROAD CROSSINC (STATION 21)

11N/9W-5Q

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents[b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hoch / Hellige	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																		
10-29-65 0925	5	56	7.4	70.5	715	7.7	58.1 / 2.90	37.7 / 3.10				159 / 2.61										300	170	< 5	Field Determination
12-15-65 1335	10.20	45	11.6	95.8	440	8.4 / 7.4	3.76[c]				0 / 0.00	134 / 2.20		4.3 / 0.12	27 / 0.44		1.7		PO_4 = 0.03			188	78	< 5	DWR
1-19-66 1040	50	41	11.4	89.0	323	8.5 / 7.9					0 / 0.00	136 / 2.23		3.6 / 0.10	9.3 / 0.15		0.6		PO_4 = 0.05			158	47	8	DWR
3-2-66 0930	30	45	12.0	99.1	270	8.5 / 8.6	28	14			6 / 0.20	122 / 2.00	28 / 0.58	1.5 / 0.04	5.5 / 0.09		0.4			162		126	16	< 5	DWR
4-11-66 1055	25	58	10.8	105.4	280	8.5	2.68[c]					140		1.4 / 0.04	8.7 / 0.14		0.6		PO_4 = 0.03 (Ortho)			134		6.8	DWR
5-10-66 1005	10	58	9.9	96.6	360	8.4	3.14[c]					195		1.2 / 0.03	2.2 / 0.04		1.5		PO_4 = 0.05 (Ortho)			157		< 5 / 3.5	DWR
6-18-66 1630	9	69	8.7	96.0	340	8.2	3.00[c]					201		0.5 / 0.01	1.8 / 0.03		0.3		PO_4 = 0.05 (Ortho)			150		< 5 / 0.5	DWR
7-19-66 1010	5	73	7.9	91.0	540	8.0 / 7.2					0 / 0.00	137 / 2.24			50 / 0.81		4.4							< 5 / 0.8	DWR
8-17-66 1000	4	77	7.6	90.4	600	8.1						171		4.1 / 0.12	52 / 0.84		6.4		PO_4 = 0.08 (Ortho) Fe = 0.08 Mn = 0.00	455				< 5 / 0.8	DWR

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hoch turbidity in Jackson Turbidity Units using Hoch Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

BIG SULPHUR CREEK ABOVE GEYSERS POWER PLANT (STATION 22)
11N/8W-19D

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents[b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hoch / Hellige	Analyzed by[e]
Mineral constituents in parts per million / equivalents per million																									
7-1-65 1130	1/4	70				/ 7.8	31 / 1.55	24 / 1.97			0 / 0.00	205 / 3.36	21 / 0.44	2 / 0.06			0.3	26	NH_3 = 0.0, S = 0.0	224		177	9		PG&E
8-3-65 1100	1/2	69				/ 7.6	39 / 1.95	29 / 2.38			0 / 0.00	245 / 4.02	30 / 0.62	2 / 0.06			0.4	32	NH_3 = 0.0, S = 0.0	280		218	17		PG&E
9-28-65 1355		70	9.6	107	490																				Field Determination
10-29-65 0855	1	58	8.6	83.9	550	8.0 /	50.1 / 2.50	35.7 / 2.90			0 / 0.00	299 / 4.90										270	25	< 5 /	Field Determination
12-6-65 1100	2	51				/ 8.3	19 / 0.95	19 / 1.56			0 / 0.00	144 / 2.36	17 / 0.18	2 / 0.06			0.1	17	NH_3 = 0.0, S = 0.0	156		126	8		PG&E
12-15-65 1410	10	44	11.6	94.4	260	7.9 / 8.3	/ 2.52[c]				0 / 0.00	141 / 2.31		3.0 / 0.08	1.0 / 0.02		0.2					126	10	< 5 /	OWR
1-19-66 1130	35	48	11.1	95.6	225	8.5 / 8.2	/ 2.26[c]				0 / 0.00	129 / 2.11		2.9 / 0.08	0.4 / 0.01		0.0		PO_4 = 0.02			113	7	< 5 /	DWR
1-21-66 1000	1	43				/ 8.0	21 / 1.05	15 / 1.23			0 / 0.00	127 / 2.08	13 / 0.27	3 / 0.08			0.1	18	NH_3 = 0.0, S = 0.0	139		113	9		PG&E
3-2-66 1010	25	46	12.0	101	179	8.3 / 8.4	20	10			2 / 0.07	99 / 1.62	8.7 / 0.18	1.1 / 0.03	0.5 / 0.01		0.1			98		93	9	< 5 /	DWR
4-13-66 1030	15	55	11.2	105.4		8.3 /	/ 1.88[c]					122		1.2 / 0.03	0.2 / 0.00		0.0		PO_4 = 0.02 (Ortho)			94		5.1 /	DWR
5-10-66 0935	8	58	10.4	102	260	8.1 /	/ 2.44[c]					171		0.8 / 0.02	1.2 / 0.02		0.2		PO_4 = 0.05 (Ortho)			122		< 5 / 0.6	DWR
6-3-66 1030		58				8.1 /	30	25			0	198	21	1			0.8	10	NH_3 = 0.0, S = 0.0	217		176			PG&E

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hoch turbidity in Jackson Turbidity Units using Hoch Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

BIG SULPHUR CREEK ABOVE GEYSERS POWER PLANT (STATION 22)
11N/8W-19D

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen		Specific conductance (micromhos at 25°C)	pH Field / Lab	Mineral constituents in parts per million / equivalents per million													Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$		Turbidity[d] in ppm Hach / Hellige	Analyzed by[e]
			ppm	%Sat			Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents[b]			Total ppm	N C ppm		
7-5-66 1000		62				8.1	36	30			0	239	27	1			0.5	27	NH_3 = 0.0 S = 0.0	272		214			PG&E
7-19-66 0930	1 1/2	69	9.2	102	430	8.1 8.2					0 0.00	256 4.20			4.0 0.06		0.4							< 5 0.1	DWR
8-3-66 1300		69				7.9	41	33			0	268	33	2			0.8	29	NH_3 = 0.0 S = 0.0	309		238			PG&E
8-17-66 0930	1	72	7.8	88.8	480	8.1						311		2.7 0.08	6.1 0.10		0.5		PO_4 = 0.41 (Ortho) Fe = 0.08 Mn = 0.03	300				< 5 0.25	DWR
9-12-66 1100		60				7.9	48	36			0	304	45	2	7		0.1		NH_3 = 0.0 S = 0.0	346		268			PG&E

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hach turbidity in Jackson Turbidity Units using Hach Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

RUSSIAN RIVER NORTH OF CLOVERDALE (STATION 23)
11N/11W-6H

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents [b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hach / Hellige	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																		
6-8-66 1450		72			233	8.5 / 8.2	25 / 1.25	/ 0.85	8.0 / 0.35	1.2 / 0.03	0 / 0.00	126 / 2.06	12 / 0.25	4.0 / 0.11	1.3 / 0.02		0.4			148		105	2		DWR
7-19-66 1050		74	10.7	124	210	8.5 / 8.2					0 / 0.00	111 / 1.82			1.0 / 0.02		0.3							< 5 / 4.7	DWR
8-17-66 1110		73	9.0	104	200	8.1						122		3.8 / 0.11	0.6 / 0.01		0.3		PO_4 = 0.04 (Ortho) Fe = 0.48 Mn = 0.01	116				< 5 / 4.2	DWR

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hach turbidity in Jackson Turbidity Units using Hach Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

ASH CREEK (STATION 24)
12N/11W-36A

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents[b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hach / Hellige	Analyzed by[e]
7-7-65 0935	2	65.5	9.4	99.9	379	8.4 / 8.6	43 / 2.14	16 / 1.30	13 / 0.56	1.4 / 0.04	11 / 0.37	188 / 3.08	18 / 0.37	5.6 / 0.16	0.3 / 0.00	0.1 / 0.00	0.4		PO_4 = 0.04 Color = 0 Fe = 0.23	194	14	172	0	< 5	DWR
9-28-65 1530	1 1/2	68	8.9	97.3	380	8.4 / 8.4	3.04[c]				4 / 0.13	179 / 2.93		5.6 / 0.16	0.6 / 0.01				PO_4 = 0.03			152	0	< 5	DWR
10-26-65 1420	3/4	67	9.5	103	420	8.5	46 / 2.30	16 / 1.30				171 / 2.80										180	40	< 5	Field Determination
12-15-65 1125	1	44	12.5	102	280	8.5 / 8.4	2.56[c]				3 / 0.10	142 / 2.33		5.6 / 0.16	1.2 / 0.02				PO_4 = 0.02			128	7	< 5	DWR
1-19-66 0930	10	42	12.6	99.8	259	8.4 / 8.2	2.36[c]				0 / 0.00	137 / 2.24		5.7 / 0.16	1.4 / 0.02				PO_4 = 0.06			118	6	26	DWR
2-28-66 1040	20	49	12.0	105		8.5						116												51	Field Determination
4-14-66 1005	6	57	11.2	108	250	8.5	2.32[c]					146		3.9 / 0.11	0.1 / 0.00				PO_4 = 0.03 (Ortho)			116		9.2	DWR
5-10-66 1110	3	58	10.4	102	220	8.5						195		4.6 / 0.13	0.0 / 0.00				PO_4 = 0.02 (Ortho)					< 5 / 2.6	DWR
6-8-66 0900	2	63	9.8	101	340	8.5	2.80[c]					220		3.8 / 0.11	0.7 / 0.01				PO_4 = 0.03 (Ortho)			140		< 5 / 0.9	DWR
7-20-66 0830	1	66	9.1	97.3	380	8.4						244							Fe = 0.12 Mn = 0.03					< 5 / 1.5	DWR
8-17-66 1135	1/2	76	8.8	104	380	8.5						238		6.8 / 0.19	0.0 / 0.00				PO_4 = 0.04 (Ortho) Fe = 0.03 Mn = 0.00	206				< 5 / 0.4	DWR

Mineral constituents in parts per million / equivalents per million

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hach turbidity in Jackson Turbidity Units using Hach Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

CUMMISKY CREEK (STATION 25)
12N/11W-9K

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents[b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hach / Hellige	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																		
7-7-65 1320	1/2	84	11.1	142	361	8.5 / 8.5	33 / 1.65	19 / 1.53	14 / 0.61	2.2 / 0.06	6 / 0.20	166 / 2.72	32 / 0.67	6.8 / 0.19	0.7 / 0.01	0.0 / 0.00	0.2		PO_4 = 0.06 Fe = 0.06 Color = 0	203	16	159	12	< 5	DWR
9-28-65 1045	1/4	70	7.9	88.2	435	7.8 / 8.7	3.86[c]				10 / 0.33	199 / 3.26		7.9 / 0.22	0.9 / 0.01				PO_4 = 0.10			193	13	< 5	DWR
10-27-65 1010	1/2	65	9.2	97.2	440	8.4	42 / 2.10	21 / 1.70			0 / 0.00	214 / 3.51										190	15	< 5	Field Determination
12-15-65 1010	3	41	12.4	96.8	268	8.0 / 8.3	2.28[c]				0 / 0.00	114 / 1.87		8.2 / 0.23	0.6 / 0.01				PO_4 = 0.06			114	20	< 5	DWR
1-18-66 1445	10	47	11.8	100	207	8.3 / 8.0	1.76[c]				0 / 0.00	94 / 1.54		5.8 / 0.16	0.5 / 0.01				PO_4 = 0.05			88	11	< 5	DWR
3-1-66 1100	15	46	11.7	98	193	8.3 / 8.5	22	8.3			2 / 0.07	95 / 1.56		4.4 / 0.12	0.4 / 0.01		0.1			113		89	8	12	DWR
4-12-66 1335	10	58	10.6	104	240	8.1	2.10[c]					116		4.9 / 0.14	0.2 / 0.00				PO_4 = 0.09 (Ortho)			105		56	DWR
5-10-66 1420	3	62	10.2	104	295	8.3						171		6.2 / 0.17	0.0 / 0.00				PO_4 = 0.07 (Ortho)					< 5 / 1.5	DWR
6-7-66 1555	2	71	9.2	104	340	8.3	2.74[c]					183		5.0 / 0.14	0.8 / 0.01				PO_4 = 0.07 (Ortho)			137		< 5 / 1.3	DWR
7-20-66 1410	1/4	90	12.1	159	340	8.8					24	195												< 5 / 2.5	DWR
8-17-66 1615	1/4	91	11.2	148	380	8.8					30	220		11 / 0.31	0.8 / 0.01				PO_4 = 0.07 (Ortho) Fe = 0.21 Mn = 0.00	232				< 5 / 1.9	DWR

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hach turbidity in Jackson Turbidity Units using Hach Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

PIETA CREEK (STATION 26)
12N/11W-2L

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents[b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hach / Hellige	Analyzed by[e]
7-7-65 0955	2	70	9.2	103	378	8.4 / 8.5	42 / 2.10	16 / 1.34	12 / 0.52	1.9 / 0.05	8 / 0.27	198 / 3.24	17 / 0.35	5.5 / 0.16	0.5 / 0.01	0.1 / 0.00	0.1		PO_4 = 0.04 Fe = 0.08 Color = 0	186	13	172	0	< 5	DWR
9-29-65 0730	1 1/2	52	9.5	86.1	440	8.5 / 8.4	3.58[c]				5 / 0.17	209 / 3.42		5.7 / 0.16	0.2 / 0.00				PO_4 = 0.04			179	0	< 5	DWR
10-27-65 0845	3/4	58	10.1	98.6	410	8.5	44 / 2.20	22 / 1.80				2.44 / 4.00										200	0	< 5	Field Determination
12-14-65 1550	5	44	12.2	99.3	295	8.4 / 8.5	2.80[c]				5 / 0.17	155 / 2.54		5.0 / 0.14	0.1 / 0.00				PO_4 = 0.03			140	5	< 5	DWR
1-19-66 0845	80	40	13.0	100	257	8.5 / 8.3	2.52[c]				0 / 0.00	139 / 2.28		4.7 / 0.13	0.6 / 0.01				PO_4 = 0.08			126	12	5	DWR
2-28-66 1105	50	47	12.4	105		8.5						146												10	Field Determination
4-14-66 1035	10	58	11.2	109	260	8.5	2.54[c]					171		2.9 / 0.08	0.0 / 0.00				PO_4 = 0.05 (Ortho)			127		4.6	DWR
5-10-66 1130	6	59	10.6	105	280	8.5						201		3.5 / 0.10	0.0 / 0.00				PO_4 = 0.07 (Ortho)					< 5 / 1.5	DWR
6-8-66 0930	5	65	10.5	111	330	8.7	3.08[c]							3.0 / 0.08	0.4 / 0.01				PO_4 = 0.04 (Ortho)			154		< 5 / 0.7	DWR

Mineral constituents in parts per million / equivalents per million

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hach turbidity in Jackson Turbidity Units using Hach Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

PELIZ CREEK (STATION 27)

13N/12W-23H

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents[b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity[d] in ppm Hach / Hellige	Analyzed by[e]
7-7-65 1030	0	71	9.3	105	350	8.0 / 8.2	37 / 1.85	25 / 2.07	10 / 0.44	1.6 / 0.04	0 / 0.00	233 / 3.82	22 / 0.46	7.7 / 0.22	0.7 / 0.01	0.1 / 0.00	0.2		PO_4 = 0.10 Fu = 3.6	221	10	196	5	32	DWR
12-15-65 0930	10	40	12.6	96.9	346	8.1 / 8.5	3.26[c]				5 / 0.17	161 / 2.64		8.2 / 0.23	1.6 / 0.02				PO_4 = 0.03			163	31	< 5	DWR
1-18-66 1410	21	48	11.9	102	286	8.3 / 8.3	2.66[c]				0 / 0.00	150 / 2.46		5.7 / 0.16	1.0 / 0.02				PO_4 = 0.07			133	10	< 5	DWR
3-1-66 1025	54	45.5	12.5	104	230	8.4 / 8.5	21	9.6			5 / 0.17	112 / 1.84		4.9 / 0.14	0.5 / 0.01		0.1			134		92	0	7	DWR
4-12-66 1305	39	60	11.0	110	260	8.5	2.52[c]					140		5.2 / 0.15	0.8 / 0.01				PO_4 = 0.06 (Ortho)			126		33	DWR
5-10-66 1350	3.2	64	11.7	122	325	8.6						214		6.4 / 0.18	0.0 / 0.00				PO_4 = 0.06 (Ortho)					< 5 / 0.8	DWR
6-7-66 1520	0.6	68	10.6	116	370	8.5	3.22[c]					238		6.7 / 0.19	1.0 / 0.02				PO_4 = 0.06 (Ortho)			161		< 5 / 0.9	DWR
7-20-66	0																								
8-17-66	Dry																								

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hach turbidity in Jackson Turbidity Units using Hach Portable Engineers Laboratory, Hellige turbidity in A P H A Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

RUSSIAN RIVER NEAR HOPLAND (STATION 28)
14N/12W-36K

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents [b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hach / Hellige	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																		
7-7-65 1055	167	67	9.8	106	200	7.5																		32	Field Determination
7-13-65 1110	222	65	10.5	111	185	7.4 / 8.4	1.62[c]		6.8 / 0.30		2 / 0.07	92 / 1.51		3.7 / 0.10			0.2				16	81	2	28	USGS
9-14-65 0905	247	62	10.3	105	191	7.2 / 7.7	20 / 1.00	8.3 / 0.68	7.2 / 0.31	1.2 / 0.03	0 / 0.00	100 / 1.64	10 / 0.21	2.8 / 0.08	0.8 / 0.01		0.1		ABS = 0.0 As = 0.00 PO_4 = 0.05	111	15	84	2	2	USGS
9-28-65 0955	255	62	9.0	92.0	200	7.5																		< 5	Field Determination
10-26-65 1250	280	69	9.4	104	235	82						122 / 2.00												13	Field Determination
11-10-65 1215	335	60	10.4		215	7.6 / 8.0	1.94[c]		7.2 / 0.31		0 / 0.00	122 / 2.00		3.4 / 0.10			0.4				16	97	0	2	USGS
12-14-65 1620	388	50	9.8	86.5	215	7.4 / 8.1	1.98[c]				0 / 0.00	115 / 1.88		5.0 / 0.14	1.4 / 0.02				PO_4 = 0.15 Fe = 0.00			99	5	35	DWR
1-13-66 1310	2860	49	11.2	97.6	186	7.0 / 7.5	1.48[c]		7.0 / 0.30		0 / 0.00	92 / 1.51		3.4 / 0.10			0.2				17	74	0	85	USGS
1-18-66 1320	318	50	10.3	90.9	218	7.3					0 / 0.00	122 / 2.00													Field Determination
3-1-66 1000	624	48	11.0	94.7	199	7.3						110													Field Determination
3-8-66 1105	832	50	11.0	99	189	7.2 / 8.2	1.68[c]		7.7 / 0.33		0 / 0.00	91 / 1.57		3.2 / 0.09			0.2				16	84	4	30	USGS
4-12-66 1240	868	56	10.6	101	170	7.7	1.38[c]					104		3.3 / 0.09	0.8 / 0.01				PO_4 = 0.21 (Ortho)			69		92	DWR

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hach turbidity in Jackson Turbidity Units using Hach Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

RUSSIAN RIVER NEAR HOPLAND (STATION 28)
14N/12W-36K

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents[b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hach / Hellige	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																		
5-12-66 0910	425	55	10.8	102	180	7.5						104							PO_4 = 0.04 (Ortho)					20/22	DWR
5-16-66 0810	324	52	11.2	103	188	7.4/7.8	18/0.90	9.2/0.76	7.0/0.30	1.1/0.03	0/0.00	98/1.61	13/0.27	3.5/0.10	1.5/0.02		0.2	11	ABS = 0.0 PO_4 = 0.15 (Ortho) As = 0.00	119	15	83	3	5	USGS
6-8-66 1010	146	64	11.8	123	210	7.9	/1.80[c]					116		2.9/0.08	1.6/0.02				PO_4 = 0.08 (Ortho)			90		5/8	DWR
7-12-66 0550	211	58	9.1	88.8	187	7.4/8.3	/1.68[c]		6.0/0.26		1/0.03	99/1.62		2.8/0.08			0.1				13	84	1	5	USGS
7-20-66 0930	212	64	10.1	106	190	7.7						104							Fe = 0.70 Mn = 0.21					30/10.5	Field Determination
8-17-66 1510	250	74	9.7	113	190	8.0						116		3.6/0.10	0.8/0.01				PO_4 = 0.04 (Ortho) Fe = 0.37 Mn = 0.01	98				< 5/1.5	DWR

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hach turbidity in Jackson Turbidity Units using Hach Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

REGION 1

Date and time sampled	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity in ppm	Coliform[d] MPN/ml	Analyzed by[e]
											Russian River near Hopland															
1951																										
Apr 12 1800	402	64	9.0	94	194	7.5			8.0 / 0.348			105 / 1.72		3.5 / 0.99								88		7		USGS
May 8 1330	550	59	9.2	91	198	7.5	21 / 1.05	9.2 / 0.757	5.6 / 0.243	0.9 / 0.023	0 / 0.00	107 / 1.75	11 / 0.23	3.8 / 0.107	1.2 / 0.019		0.44	13	(a)	118[b]	12	90				USGS
Jun 12 1615	108	74	9.0	104	219	7.8						121 / 1.98		3.6 / 0.102								92		25		DWR
Jul 11 0915	134	68	7.6	83	206	7.4						110 / 1.80		2.0 / 0.056								87		25		DWR

Mineral constituents in parts per million / equivalents per million.

a Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and chromium (Cr), reported here as $\frac{0.0}{0.00}$ except as shown.

b Determined by addition of analyzed constituents.

c Gravimetric determination.

d Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by Calif. Dept of Public Health, Division of Laboratories.

e Mineral analyses made by USGS, Quality of Water Branch (USGS), Pacific Chemical Consultant (PCC), Metropolitan Water District (MWD), Los Angeles Dept. of Water & Power (LADWP), City of Los Angeles Dept of Pub Health (LADPH), Long Beach Dept. of Pub Health (LBDPH) & State Division of Water Resources (DWR), as indicated

ANALYSES OF SURFACE WATER

REGION 1

Date and time sampled	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total Dissolved solids in ppm	Per-cent sod-ium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbid-ity in ppm	Coliform[d] MPN/ml	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																			
											Russian River near Hopland															
1951 (continued)																										
Aug 16 1545	92	77	8.8	104	213	8.0						116 / 1.90		6 / 0.17								92		25		DWR
Sep 9 1415	125	72	9.4	107	210	8.0	23 / 1.15	9.0 / 0.740	7.5 / 0.326	1.0 / 0.026	0 / 0.00	120 / 1.97	9.0 / 0.187	4.2 / 0.118	1.3 / 0.021	0 / 0.00	0.33	11	(a)	125[b]	15	94	0			USGS
Oct 9 1415	161	65	9.6	102	208	7.2			6.0 / 0.261		0 / 0.00	110 / 1.80		5.2 / 0.147							13	90	0	5		USGS
Nov 13 1425	294	54	9.4	88	211	7.8			8.0 / 0.348		0 / 0.00	110 / 1.80		5.5 / 0.155							16	92	2	50		USGS
Dec 10 1350	903	47	10.6	90	189	7.3						98 / 1.61		4 / 0.11								76		40	620 0.23–7,000+	USGS
1952																										
Jan 9 1345	1,430	45	11.0	90	165	7.3					0 / 0.00	84 / 1.38		4 / 0.11								70		55		DWR
Feb 11 1305	2,500	48	11.4	98	146	7.4			5.0 / 0.217		0 / 0.00	75 / 1.23		3.5 / 0.099							14	64	3	240		USGS
Mar 6 1500	2,180	46	11.3	95	143	7.6			5.4 / 0.235		0 / 0.00	72 / 1.18		3.5 / 0.099							16	63	4	200		USCS
Apr 21 1315	460	59	10.6	104	184	7.5						102 / 1.67		3 / 0.08								86		8		DWR
May 19 1345	378	66	9.0	96	166	7.6	18 / 0.90	7.0 / 0.576	6.1 / 0.625	0.9 / 0.023	0 / 0.00	89 / 1.46	8.6 / 0.179	5.5 / 0.155	0.4 / 0.006	0.0 / 0.00	0.29	17	(a) Sn=0.00	108[b]	15	74	1			USGS
Jun 16 1230	308	70	9.4	104	164	8.1					0 / 0.00	92 / 1.51		4 / 0.11								71		4		DWR
Jul 7 1500	151	79	9.4	114	197	8.3					0 / 0.00	103 / 1.69		5 / 0.14								86		1		DWR
Aug 4 1415	244	77	9.0	107	165	8.3	16 / 0.82				0 / 0.00	94 / 1.54		6 / 0.17	1.13 / 0.02							72		3		DWR
Sep 15 1504	208	72	10.8	122	179	7.9					0 / 0.00	99 / 1.62		3.0 / 0.085								79				USGS
Oct 6 1500	168	64	10.3	111	186	7.8	11 / 0.55	14 / 1.15	8.0 / 0.348	1.0 / 0.026	0 / 0.00	105 / 1.72	7.0 / 0.146	4.1 / 0.116	1.0 / 0.016	0.0 / 0.00	0.33	11		109[b]	17	85	0			USGS

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b Determined by addition of analyzed constituents

c Gravimetric determination.

d Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by Calif. Dept of Public Health, Division of Laboratories.

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ANALYSES OF SURFACE WATER

REGION 1

Date and time sampled	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity in ppm	Coliform[d] MPN/ml	Analyzed by[e]
											Mineral constituents in parts per million / equivalents per million															
											Russian River near Hopland															
1952 (continued)																										
Nov 3 1210	201	58	12.3	120	194	7.7					0/0.00	108/1.77		3/0.08								82		3		DWR
Dec 2 0920	794	45	10.2	84	187	6.4					0/0.00	73/1.20		5/0.14								73		250	42 0.06–2,400	DWR
1953																										
Jan 12 1320	2,720	57	10.2	98	143	6.5	13/0.65	6.4/0.526	6.7/0.291	1.2/0.031	0/0.00	72/1.18		5.0/0.141							19	59	0			USGS
Feb 9 1645	847	56	10.1	96	244	7.5	23/1.15	12/0.99	11/0.48	0.9/0.023	0/0.00	128/2.10		6.5/0.183							18	107	2			USGS
Mar 9 1450	384	50	10.5	93	179	7.5	21/1.05	7.0/0.576	8.2/0.357		0/0.00	98/1.61		5.0/0.141			0.38				18	81	1			USGS
Apr 6 1530	520	58	10.0	97	188	8.1	19/0.95	8.1/0.666	7.6/0.330		0/0.00	99/1.62		4.5/0.127			0.22				17	81	0	20		USGS
May 4 1700	604	72	9.1	103	184	7.3	18/0.90	8.3/0.683	7.8/0.339	1.1/0.028	0/0.00	97/1.59	11/0.23	4.8/0.135	1.8/0.029	0.2/0.011	0.22	14	Al 0.02; Zn 0.03; (a)	115[b]	17	79	0	20		USGS
Jun 8 1535	450	65	10.9	115	181	7.7					0/0.00	94/1.54		5/0.14			0.13				18	78		7		DWR
Jul 6 1520	285	75	8.9	104	163	7.4			5.1/0.222		0/0.00	90/1.48		3/0.08			0.19				13	75		8		DWR
Aug 3 1247	253	69	9.3	102	173	7.3	19/0.95	7.1/0.584	6.1/0.265	0.8/0.020	0/0.00	94/1.54		3.2/0.090			0.08				15	77	0	1		USGS
Sep 14 1520	253	80	8.9	109	201	7.9	19/0.95	8.3/0.683	6.7/0.291	0.8/0.020	0/0.00	100/1.64	8.3/0.173	4.0/0.113	1.2/0.019	0.0/0.00	0.40	11	Fe 0.01; Zn 0.01; (a)	109[b]	15	82	0	2		USGS
Oct 5 1447	269	74	9.2	103	186	7.8	20/1.00	7.6/0.625	8.2/0.357	0.8/0.020	0/0.00	103/1.69		3.5/0.099			0.33				18	81	0	1		USGS
Nov 2 1310	245	59	10.6	104	201	7.4			7.2/0.313		0/0.00	113/1.85		4/0.11			0.4				15	90		2		DWR
Dec 7 1330	1,070	50	11.0	97	160	7.2	15/0.75	6.9/0.567	7.4/0.322	1.6/0.041	0/0.00	80/1.31		4.8/0.135			0.22				19	66	0	64	23 0.62–7,000	USGS

a Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and chromium (Cr), reported here as $\frac{0.0}{0.00}$ except as shown.

b Determined by addition of analysed constituents.

c Gravimetric determination.

d Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by Calif. Dept. of Public Health, Division of Laboratories.

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ANALYSES OF SURFACE WATER

REGION 1

Date and time sampled	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity in ppm	Coliform[d] MPN/ml	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																			
							Russian River near Hopland																			
1954																										
Jan 4 1420	420	52	11.0	99	188	7.5	20 / 1.00	7.6 / 0.625	7.4 / 0.322	1.0 / 0.026	0 / 0.00	100 / 1.64		5.5 / 0.155			0.28				16	81	0	22		USGS
Feb 1 1600	1,210	57	10.1	97	166	7.4	16 / 0.80	7.1 / 0.584	5.8 / 0.252	1.0 / 0.026	0 / 0.00	85 / 1.39		4.0 / 0.113			0.13				15	69	0	35		USGS
Mar 1 1015	576	54	10.4	96	186	6.7	18 / 0.90	8.7 / 0.715	7.8 / 0.339	0.8 / 0.020	0 / 0.00	96 / 1.57		3.5 / 0.099			0.16				17	81	2	30		USGS
Apr 5 1310	4,300	56	9.6	91	126	7.5	12 / 0.60	5.7 / 0.469	5.6 / 0.244	1.2 / 0.031	0 / 0.00	64 / 1.05		2.0 / 0.056			0.13				18	53	1	75		USGS
May 3 1340	495	62	10.2	104	184	7.4	20 / 1.00	8.0 / 0.658	6.4 / 0.278	0.8 / 0.020	0 / 0.00	98 / 1.61	9.4 / 0.196	3.3 / 0.093	0.4 / 0.006	0.1 / 0.005	0.23	11	Fe 0.02; (a)	111[b]	14	83	2	6		USGS
Jun 3 2035	240	61	9.6	96	252	7.6	25 / 1.25	13 / 1.07	8.7 / 0.378	1.3 / 0.033	0 / 0.00	138 / 2.26	11 / 0.23	6.0 / 0.169			0.58				14	116	3	22		USGS
Jul 12 1430	160	84	10.0	128	194	8.0	20 / 1.00	8.0 / 0.658	7.4 / 0.322	1.2 / 0.031	0 / 0.00	106 / 1.74		4.5 / 0.127			0.32				16	83	0	0		USGS
Aug 2 1600	183	78	9.	108	188	8.1	21 / 1.05	7.4 / 0.609	6.8 / 0.296	1.1 / 0.028	0 / 0.00	99 / 1.62		3.5 / 0.99			0.26				15	83	2	9		USGS
Sep 13 1545	289	71	8.8	99	185	7.4	21 / 1.05	6.7 / 0.552	6.4 / 0.278	0.9 / 0.023	0 / 0.00	99 / 1.62	6.7 / 0.139	4.0 / 0.113	0.7 / 0.011	0.1 / 0.005	0.33	10	Fe 0.01; As 0.01; (a)	106[c]	15	80	0	2		USGS
Oct 4 1330	296	65	10.0	106	189	7.7	22 / 1.10	6.3 / 0.522	6.0 / 0.261	0.7 / 0.019	0 / 0.00	102 / 1.67		4.0 / 0.113			0.27	7.3			14	81	0	2		USGS
Nov 7 1100	90	59	11.4	112	226	7.4	26 / 1.30	9.5 / 0.783	8.1 / 0.352	0.7 / 0.018	0 / 0.00	127 / 2.08		6.0 / 0.169			0.44				14	104	0	8		USGS
Dec 6 1230	2,670		11.4		127	7.5	12 / 0.60	6.3 / 0.521	5.1 / 0.222	2.0 / 0.051	0 / 0.00	62 / 1.02		3.0 / 0.085			0.11				16	56	5	80	62. 2.3– 7,000.	USGS

a Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and chromium (Cr), reported here as $\frac{0.0}{0.00}$ except as shown.

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c Gravimetric determination.

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ANALYSES OF SURFACE WATER

REGION 1

Date and time sampled	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total Dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity in ppm	Coliform[d] MPN/ml	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																			
												Russian River near Hopland														
1955																										
Jan 3 1620	870	46	11.2	94	169	7.2	18 / 0.898	7.6 / 0.622	6.4 / 0.278	1.0 / 0.026	0 / 0.000	88 / 1.442		4.5 / 0.127			0.34				15	76	4	20		USGS
Feb 7 1300	580	50	11.7	103	191	7.3	20 / 0.998	8.3 / 0.682	7.8 / 0.339	0.7 / 0.018	0 / 0.000	100 / 1.639		5.2 / 0.147			0.25				17	84	2	3		USGS
Mar 1 1415	712	46	13.4	112	179	7.0	16 / 0.798	10 / 0.826	7.6 / 0.330	1.1 / 0.028	0 / 0.000	98 / 1.606		4.8 / 0.135			0.23				17	81	1	4		USGS
Apr 4 1245	171	56	11.0	102	226	7.9	23 / 1.148	9.9 / 0.812	9.6 / 0.417	1.3 / 0.033	0 / 0.000	125 / 2.049		6.0 / 0.169			0.39				17	98	0	10		USGS
May 2 1200	652	60	9.8	98	191	6.8	22 / 1.098	7.3 / 0.602	7.7 / 0.335	0.8 / 0.020	0 / 0.000	103 / 1.688	10 / 0.208	5.5 / 0.155	0.9 / 0.015	0.0 / 0.000	0.28	13	Fe 0.06; Al 0.01; (a) PO_4 0.05	118[b]	16	85	1	4		USGS
Jun 23 1230	224	70	7.8	87	189	7.2	19 / 0.948	7.0 / 0.572	7.3 / 0.317	0.8 / 0.020	0 / 0.000	104 / 1.704		4.5 / 0.127			0.25		Al 0.05; (a)		17	76	0	0.8		USGS
Jul 11 1315	186	75	10.2	120	182	7.6	19 / 0.948	7.9 / 0.652	7.8 / 0.339	0.9 / 0.023	9 / 0.300	82 / 1.344		4.2 / 0.118			0.33				17	80	0	0.8		USGS
Aug 1 1215	195	77	11.0	131	188	7.7	20 / 0.998	7.3 / 0.602	6.7 / 0.291	1.1 / 0.028	0 / 0.000	104 / 1.704		6.0 / 0.169			0.35				15	80	0	3		USGS
Sep 12 1520	177	79	10.6	130	178	7.6	21 / 1.048	6.1 / 0.500	6.9 / 0.300	0.5 / 0.013	13 / 0.433	71 / 1.164	9.0 / 0.187	4.1 / 0.116	0.6 / 0.010	0.2 / 0.011	0.40	9.3	Fe 0.03; Cu 0.01; (a)	106[b]	16	77	0	4.0		USGS
Oct 3 1600	204	64	11.2	117	196	7.9	22 / 1.098	7.5 / 0.618	7.3 / 0.318	0.8 / 0.020	0 / 0.000	108 / 1.770		2.7 / 0.076			0.46				15	86	0	2		USGS
Nov 14 1415	245	51	11.4	102	199	6.8	24 / 1.198	6.7 / 0.554	7.8 / 0.339	1.0 / 0.026	0 / 0.000	111 / 1.819		4.2 / 0.118			0.57				16	88	0	2		USGS
Dec 5 1500	249	48	9.0	77	226	6.9	25 / 1.248	8.2 / 0.672	11 / 0.478	1.0 / 0.026	0 / 0.000	116 / 1.901		7.7 / 0.217			0.76				20	96	1	1		USGS
																									median 18	
																									minimum .045–	
																									maximum 1300	

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REGION 1

Date and time sampled	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents[a]	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity in ppm	Coliform[d] MPN/ml	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																			
											Russian River near Hopland															
1956																										
Jan 16 1320	6,680	52	10.0	91	122	6.9	11 / 0.549	6.2 / 0.511	4.6 / 0.200	1.4 / 0.036	0 / 0.000	64 / 1.049		1.2 / 0.034			0.05				15	53	1	600		USGS
Feb 17 1205	650	45	11.0	91	191	6.9	20 / 0.998	8.2 / 0.674	6.8 / 0.296	0.9 / 0.023	0 / 0.000	104 / 1.705		2.9 / 0.082			0.27				15	84	0			USGS
Mar 5 1300	2,330	50	11.0	97	165	7.2	17 / 0.848	7.7 / 0.632	5.5 / 0.239	1.1 / 0.028	0 / 0.000	89 / 1.459		3.5 / 0.099			0.09				14	74	1	75		USGS
Apr 2 1115	575		10.6		184	7.7	18 / 0.898	8.8 / 0.722	6.9 / 0.300	0.9 / 0.023	0 / 0.000	114 / 1.868		2.0 / 0.056			0.77				15	81	0	25		USGS
May 7 1340	428	62	9.8	100	193	7.7*	24 / 1.198	5.5 / 0.450	7.2 / 0.313	1.0 / 0.026	0 / 0.000	105 / 1.721	9.6 / 0.200	2.6 / 0.073	0.9 / 0.015	0.3 / 0.016	0.25	13	Fe 0.02; Cu 0.02; Zn 0.01; PO_4 0.10 (a)	116[b]	16	82	0	15		USGS
June 11 1530	255	75	9.3	109	208	6.9	23 / 1.148	7.7 / 0.632	8.7 / 0.378	1.2 / 0.031	0 / 0.000	112 / 1.836		5.8 / 0.164			0.20				17	89	0	4		USGS
July 2 1300	260	75	10.4	121	182	8.2	20 / 0.998	8.3 / 0.682	6.8 / 0.296	1.1 / 0.028	0 / 0.000	106 / 1.737		3.5 / 0.099			0.39				15	84	0	1		USGS
Aug 6 1350	181	77	12.6	150	172	7.4	19 / 0.948	7.7 / 0.632	6.3 / 0.274	1.0 / 0.026	0 / 0.000	100 / 1.639		2.5 / 0.070			0.18				15	79	0	3		USGS
Sept 11 1110	223	70	9.3	104	182	6.8	20 / 0.998	7.3 / 0.602	6.1 / 0.265	0.9 / 0.023	0 / 0.000	104 / 1.705	4.8 / 0.100	3.5 / 0.099	0.6 / 0.010	0.0 / 0.000	0.35	13	Al 0.01; Cu 0.01; PO_4 0.10; (a)	108[b]	14	80	0	1.0		USGS
Oct 5 1810	169	70	9.2	102	208	7.9	22 / 1.098	8.0 / 0.662	9.4 / 0.409	0.9 / 0.023	0 / 0.000	110 / 1.803		4.4 / 0.124			0.59				19	88	0	10		USGS
Nov 4 1145	331	77	11.0	131	219	7.5	22 / 1.098	9.3 / 0.762	9.2 / 0.400	0.9 / 0.023	0 / 0.000	118 / 1.934		6.6 / 0.186			0.62				18	93	0	9		USGS
Dec 3 1320	331	49	13.6	119	227	8.0	26 / 1.30	8.4 / 0.69	8.9 / 0.39	0.8 / 0.02	0 / 0.000	128 / 2.10		6.5 / 0.18			0.30				16	100	0	5	median 23 minimum .62 maximum 2400	USGS
*Lab pH																										

a Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and chromium (Cr), reported here as $\frac{0.0}{0.00}$ except as shown.

b Determined by addition of analysed constituents

c Gravimetric determination.

d Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by Calif. Dept of Public Health, Division of Laboratories

e Mineral analyses made by USGS, Quality of Water Branch (USGS), Pacific Chemical Consultant (PCC), Metropolitan Water District (MWD), Los Angeles Dept. of Water & Power (LADWP), City of Los Angeles Dept of Pub Health (LADPH), Long Beach Dept of Pub Health (LBDPH) or State Division of Water Resources (DWR), as indicated

ANALYSES OF SURFACE WATER

NORTH COASTAL REGION

Date and time sampled	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm b	Per cent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity in ppm	Coliform[d] MPN/ml	Analyzed by e
							Mineral constituents in parts per million / equivalents per million																			
1957												RUSSIAN RIVER NEAR HOPLAND														
1/7 1310	286	46	14.0	117	274	8.1	27 1.35	10 0.85	12 0.52	0.9 0.02	0 0.00	142 2.33		7.0 0.20			0.80				19	110	0	0.6		USGS
2/4 1145	500	47	13.2	112	224	7.6	22 1.10	9.7 0.80	10 0.44	0.9 0.02	0 0.00	115 1.88		8.0 0.23			0.52				19	95	1	20		USGS
3/4 1315	1600	54	12.2	113	153	7.5	12 0.60	9.2 0.76	6.4 0.28	1.4 0.04	0 0.00	83 1.36		2.7 0.08			0.20				17	68	0	55		USGS
4/1 1515	620	60	10.0	100	205	6.8	20 1.00	10 0.84	8.4 0.37	0.8 0.02	0 0.00	108 1.77		5.2 0.15			0.19				17	92	3	10		USGS
5/6 1240	510	62	9.8	100	183	6.9	20 1.00	8.0 0.66	6.5 0.28	0.6 0.02	0 0.00	98 1.61	9.6 0.20	4.0 0.11	0.6 0.01	0.2 0.01	0.18	16	PO_4 0.10 Fe 0.01 Al 0.07 Cu 0.08 Zn 0.03 a	114	14	83	3	3.4		USGS
6/3 1425	490	72	9.8	112	183	7.1	21 1.05	10 0.83	6.9 0.30	0.7 0.02	0 0.00	100 1.64		3.5 0.10			0.26				14	94	12	1		USGS
7/8 1130	170	74	8.6	100	188	8.3			7.2 0.31		0 0.00	104 1.70		3.8 0.11			0.25				16	80	0	0.8		USGS
8/5 1320	184	69	9.6	105	173	8.1			6.5 0.28		0 0.00	98 1.61		3.8 0.11			0.23				14	85	5	5		USGS
9/10 1200	170	67	9.6	103	186	7.7	19 0.95	8.9 0.73	7.8 0.34	1.1 0.03	0 0.00	112 1.84	1.0 0.02	3.7 0.10	0.3 0.00	0.1 0.01	0.39	14	PO_4 0.05 Al 0.04 a	111	17	84	0	6		USGS
10/15 0800	115	57	8.4	81	185	7.3			7.4 0.32		0 0.00	96 1.57		4.0 0.11			0.40				17	78	0	13	Median 62	USGS
11/4 1300	370	55	10.0	94	191	7.4			7.1 0.31		0 0.00	107 1.75		5.5 0.16			0.32				16	84	0	3	Max. 7000	USGS
12/16 1345	2000	55	10.0	93	147	7.7			6.4 0.28		0 0.00	78 1.28		4.0 0.11			0.40				18	66		275	Min. 1.3	USGS

a Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and chromium (Cr), reported here as $\frac{0.0}{0.00}$ except as shown.

b Determined by addition of analyzed constituents.

c Gravimetric determination.

d Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by Calif. Dept. of Public Health, Division of Laboratories.

e Mineral analyses made by USGS, Quality of Water Branch (USGS), Pacific Chemical Consultant (PCC), Metropolitan Water District (MWD), Los Angeles Dept. of Water & Power (LADWP), City of Los Angeles Dept. of Pub Health (LADPH), Long Beach Dept. of Pub Health (LBDPH) or State Department of Water Resources (DWR), as indicated

ANALYSES OF SURFACE WATER

NORTH COASTAL REGION (1)

Date and time sampled PST	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH [f]	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity in ppm	Coliform [d] MPN/ml	Analyzed by [e]
							Mineral constituents in parts per million / equivalents per million																			
1958											RUSSIAN RIVER NEAR HOPLAND															USGS
1/15 1630	1,470	50	11.4	100	168	7.6	---	---	6.7/0.29	---	0/0.00	92/1.51	---	5.0/0.14	---	---	0.04/---	--		---	17	73	0	40		
2/3 1130	6,000	46	10.6	89	123	7.3	---	---	5.0/0.22	---	0/0.00	64/1.05	---	3.0/0.08	---	---	0.00/---	--		---	17	52	0	165	Maximum 7000.+ Minimum 2.3 Median 62.	
3/10 1120	990	53	11.2	103	202	7.6	---	---	6.6/0.29	---	0/0.00	110/1.80	---	5.0/0.14	---	---	0.08/---	--		---	14	89	0	40		
4/4 1105	6,700	51	10.4	93	120	7.4	---	---	5.1/0.22	---	0/0.00	70/1.15	---	3.5/0.10	---	---	0.08/---	---		---	16	56	0	325		
5/9 1130	332	65	9.8	104	207	8.4	22/1.10	9.5/0.78	7.6/0.33	1.7/0.04	0/0.00	111/1.82	11/0.23	4.8/0.14	0.5/0.01	0.0/0.00	0.12/---	17/--	a Fe 0.02 Al 0.06 Cu 0.01 PO_4 0.10	129[b]	15	94	3	20		
6/6 1120	270	65	9.0	95	187	7.9	---	---	6.4/0.28	---	0/0.00	102/1.67	---	2.4/0.07	---	---	0.20/---	--		---	14	85	1	6		
7/11 1140	175	75	8.0	93	196	7.7	---	---	6.8/0.30	---	0/0.00	109/1.79	---	5.6/0.16	---	---	0.2/---	--		---	15	85	0	2		
8/8 1140	184	74	9.8	114	191	8.3	---	---	7.4/0.32	---	0/0.00	100/1.64	---	6.5/0.18	---	---	0.7/---	--		---	17	80	0	3		
9/12 1130	228	66	9.0	96	167	8.0	19/0.95	7.2/0.59	4.6/0.20	0.9/0.02	0/0.00	92/1.51	5.8/0.12	3.5/0.10	0.5/0.01	0.0/0.00	0.3/---	10/--	a Zn 0.01 PO_4 0.00	97[b]	11	77	2	15		
10/7 1420	278	70	9.8	109	191	7.4	---	---	6.7/0.29	---	0/0.00	107/1.75	---	4.8/0.14	---	---	0.3/---	--		---	15	84	0	5		
11/10 1220	270	57	10.1	97	197	8.2	---	---	6.0/0.26	---	0/0.00	110/1.80	---	4.8/0.14	---	---	0.5/---	--		---	13	88	0	5		
12/5 0820	149	49	9.4	82	228	7.3	---	---	7.8/0.34	---	0/0.00	128/2.10	---	6.5/0.18	---	---	0.5/---	--		---	14	102	0	10		

a Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and hexavalent chromium (Cr^{+6}), reported here as $\frac{0.0}{0.00}$ except as shown.
b Determined by addition of analyzed constituents.
c Gravimetric determination.
d Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by Calif. Dept. of Public Health, Division of Laboratories, or United States Public Health Service.
e Mineral analyses made by USGS, Quality of Water Branch (USGS), United States Public Health Service (USPHS), San Bernardino County Flood Control District (SBCFCD), Metropolitan Water District (MWD), Los Angeles Dept. of Water & Power (LADWP), City of Los Angeles Dept. of Pub. Health (LADPH), Long Beach Dept. of Pub. Health (LBDPH), Terminal Testing Laboratories, Inc. (TTL), State Department of Water Resources (DWR), as indicated.
f Field pH except when noted with *

ANALYSES OF SURFACE WATER

NORTH COASTAL REGION (NO. 1)

RUSSIAN RIVER NEAR HOPLAND

Date and time sampled P.S.T.	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity in ppm	Coliform[h] MPN/ml	Analyzed by[i]
							Mineral constituents in parts per million / equivalents per million																			
1959																									Median 41	USGS
1/7 0800	278	49	9.6	84	172	7.3[a]	1.40[c]		7.6 / 0.33		0.0 / 0.00	78 / 1.28		9.0 / 0.25			0.2			102[e]	19	70	6	25	Maximum 2,400.	
2/6 0925	285	48	10.2	88	197	7.3[a]	1.66[c]		8.7 / 0.38		0.0 / 0.00	98 / 1.61		6.5 / 0.18			0.4			116[e]	19	83	3	10	Minimum <0.045	
3/2 1300	683	54	9.9	92	190	7.1[a]	1.68[c]		6.8 / 0.30		0.0 / 0.00	95 / 1.56		5.5 / 0.16			0.3			112[e]	15	84	6	30		
4/2 1230	450	57	10.0	96	180	7.2[a]	1.66[c]		6.9 / 0.30		0.0 / 0.00	92 / 1.51		5.2 / 0.15			0.2			106[e]	15	83	8			
5/15 0730	130	58	7.0	68	190	7.7[b]	20 / 1.00	7.7 / 0.63	7.7 / 0.33	1.4 / 0.04	0.0 / 0.00	100 / 1.64	8.6 / 0.18	4.5 / 0.13	1.2 / 0.02	0.1 / 0.01	0.3	12	Fe 0.05 Al 0.11[d] PO_4 0.10	113[f]	16	82	0	6		
6/10 1300	165	63	11.0	113	179	7.9[a]	1.68[c]		7.2 / 0.31		0.0 / 0.00	94 / 1.54		7.0 / 0.20			0.2			106[e]	16	84	7	20		
7/1 1330	217	64	10.0	104	168	7.3[a]	1.48[c]		6.0 / 0.26		0.0 / 0.00	92 / 1.51		4.0 / 0.11			0.3			99[e]	15	74	0	10		
8/13 0740	210	63	7.6	79	172	7.3[a]	1.56[c]		7.0 / 0.30		0.0 / 0.00	99 / 1.62		4.0 / 0.11			0.3			102[e]	16	78	0	3		
9/3 1545	221	71	9.4	105	176	7.8[a]	18 / 0.90	7.9 / 0.65	7.0 / 0.30	1.7 / 0.04	0.0 / 0.00	96 / 1.57	5.4 / 0.11	5.0 / 0.14	0.6 / 0.01	0.0 / 0.00	0.3	10	Al 0.04 Fe 0.06[d] PO_4 0.05 Cu 0.02	103[f]	16	77	0	2		
10/14 1645	322	65	8.2	87	179	7.3[a]	1.62[c]		4.3 / 0.19		0.0 / 0.00	99 / 1.62		5.2 / 0.15			0.2			106[e]	10	81	0	5		
11/4 1530	322	64	8.4	88	183	7.3[a]	1.60[c]		7.0 / 0.30		0.0 / 0.00	101 / 1.66		3.2 / 0.09			0.3			108[e]	16	80	0	5		
12/3 1430	318	53	10.2	95	192	7.3[a]	1.76[c]		7.6 / 0.33		0.0 / 0.00	110 / 1.80		4.0 / 0.11			0.5			114[e]	16	88	0	3		

a Field pH.

b Laboratory pH.

c Sum of calcium and magnesium in epm.

d Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and hexavalent chromium (Cr^{+6}), reported here as $\frac{0.0}{0.00}$ except as shown.

e Derived from conductivity vs TDS curves.

f Determined by addition of analyzed constituents.

g Gravimetric determination.

h Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by California Department of Public Health, Division of Laboratories, or United States Public Health Service.

i Mineral analyses made by United States Geological Survey, Quality of Water Branch (USGS); United States Department of the Interior, Bureau of Reclamation (USBR); United States Public Health Service (USPHS);; San Bernardino County Flood Control District (SBCFCD); Metropolitan Water District of Southern California (MWD); Los Angeles Department of Water and Power (LADWP); City of Los Angeles, Department of Public Health (LADPH); City of Long Beach, Department of Public Health (LBDPH); Terminal Testing Laboratories, Inc. (TTL); or California Department of Water Resources (DWR); as indicated.

ANALYSES OF SURFACE WATER

NORTH COASTAL REGION (NO. 1)

RUSSIAN RIVER NEAR HOPLAND

Date and time sampled P.S.T.	Discharge in cfs	Temp in °F	Dissolved oxygen		Specific conductance (micromhos at 25°C)	pH[a]	Mineral constituents in parts per million / equivalents per million													Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$		Turbidity in ppm	Coliform[h] MPN/ml	Analyzed by[i]
			ppm	%Sat			Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents			Total ppm	N.C. ppm			
1960																										USGS
1/14 1110	193	42	10.6	86	223	7.3	1.94[c]		12 / 0.52		0.0 / 0.00	118 / 1.93		10 / 0.28			0.7			132[e]	21	97	0	5	Median 23.	
2/4 0850	782	49	9.8	87	145	7.3	1.32[c]		6.6 / 0.29		0.0 / 0.00	68 / 1.11		9.0 / 0.25			0.1			86[e]	18	66	10	175	Maximum 7,000.	
3/10 1425	1,560	52	9.9	92	162	7.3	1.40[c]		5.6 / 0.24		0.0 / 0.00	78 / 1.28		6.2 / 0.17			0.2			96[e]	15	70	6	350	Minimum 0.23	
4/14 1420	716	59	10.0	101	162	7.3	1.42[c]		5.1 / 0.22		0.0 / 0.00	82 / 1.34		4.8 / 0.14			0.2			96[e]	13	71	4	50		
5/11 1300	349	63	10.2	108	168	7.5	18 / 0.90	7.5 / 0.62	5.7 / 0.25	1.2 / 0.03	0.0 / 0.00	93 / 1.52	9.0 / 0.19	4.5 / 0.13	1.3 / 0.02	0.0 / 0.00	0.3	12	Fe 0.06 Al 0.11 PO_4 0.10[d] Cu 0.01	106[f]	14	76	0	8		
6/14 1800	183	72	9.3	108	180	7.7	1.58[c]		6.0 / 0.26		0.0 / 0.00	97 / 1.59		7.0 / 0.20			0.3			106[e]	14	79	0	1		
7/14 0700	227	61	8.0	82	170	7.3	1.62[c]		5.4 / 0.23		0.0 / 0.00	92 / 1.51		6.0 / 0.17			0.1			100[e]	12	81	6	5		
8/4 1230	217	68	9.1	102	172	7.5	1.20[c]		14 / 0.61		0.0 / 0.00	96 / 1.57		4.5 / 0.13			0.3			101[e]	34	60	0	2		
9/14 1345	193	70	9.5	118	183	7.7	17 / 0.85	9.6 / 0.79	8.0 / 0.35		0.0 / 0.00	104 / 1.70	8.0 / 0.17	4.0 / 0.11	0.6 / 0.01	0.0 / 0.00	0.3	14	Al 0.07 PO_4 0.05 Zn 0.05[d]	114[f]	17	82	0	15		
10/12 1550	248	67	9.4	103	183	7.5	19 / 0.95	8.6 / 0.71	6.4 / 0.28		0.0 / 0.00	97 / 1.59		3.5 / 0.10			0.2			108[e]	14	83	3	1		
11/3 1440	314	59	9.7	98	183	7.3	1.62[c]		8.0 / 0.25	1.0 / 0.03	0.0 / 0.00	100 / 1.64		8.8 / 0.25			0.4			108[e]	18	81	0	2		
12/7 1400	297	50	10.0	90	217	7.2	1.90[c]		10 / 0.44		0.0 / 0.00	108 / 1.77		6.5 / 0.18			0.4			128[e]	19	95	6	28		

a Field pH.

b Laboratory pH.

c Sum of calcium and magnesium in epm.

d Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and hexavalent chromium (Cr^{+6}), reported here as $\frac{0.0}{0.00}$ except as shown.

e Derived from conductivity vs TDS curves.

f Determined by addition of analyzed constituents.

g Gravimetric determination.

h Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by California Department of Public Health, Division of Laboratories, or United States Public Health Service.

i Mineral analyses made by United States Geological Survey, Quality of Water Branch (USGS); United States Department of the Interior, Bureau of Reclamation (USBR); United States Public Health Service (USPHS); San Bernardino County Flood Control District (SBCFCD); Metropolitan Water District of Southern California (MWD); Los Angeles Department of Water and Power (LADWP); City of Los Angeles, Department of Public Health (LADPH); City of Long Beach, Department of Public Health (LBDPH); Terminal Testing Laboratories, Inc. (TTL); or California Department of Water Resources (DWR); as indicated.

ANALYSES OF SURFACE WATER

NORTH COASTAL REGION (1)

RUSSIAN RIVER NEAR HOPLAND

Mineral constituents in parts per million / equivalents per million (values shown as ppm/epm)

Date and time sampled P.S.T	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH[a]	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity in ppm	Coliform[h] MPN/ml	Analyzed by[i]
1961																										USGS
1/4 1425	410	48	10.8	94	175	7.3	/1.48[c]		6.6/0.29		0.0/0.00	92/1.51		4.5/0.13			0.3			103[g]	16	74	0	15	Median 50.	
2/17 1000	1,570	48	11.5	100	157	7.3	/1.38[c]		5.9/0.26		0.0/0.00	76/1.25		3.8/0.11			0.2			93[e]	16	69	7	40	Maximum 2,400.	
3/13 1305	1,260	53	10.2	95	163	7.3	/1.38[c]		5.9/0.26		0.0/0.00	84/1.38		2.7/0.08			0.3			96[e]	16	69	0	35	Minimum 0.23	
4/12 1510	850	58	9.4	93	190	7.3	/1.64[c]		9.2/0.40		0.0/0.00	98/1.61		5.5/0.16			0.2			112[e]	20	82	2	8		
5/3 1400	525	60	10.3	105	175	7.3	18/0.90	7.8/0.64	7.7/0.33	1.4/0.04	0.0/0.00	94/1.54	8.6/0.18	3.9/0.11	0.6/0.01	0.2/0.01	0.3	12	Fe 0.08 Al 0.07[d] PO_4 0.05	107[f]	17	77	0	3		
6/1 1400	225	65	9.9	106	197	7.7	/1.71[c]		7.4/0.32		0.0/0.00	101/1.66		4.8/0.14			0.4			116[e]	16	86	3	2		
7/7 1530	329	69	8.7	98	169	7.6	/1.50[c]		5.9/0.26		0.0/0.00	94/1.54		2.2/0.06			0.1			100[e]	15	75	0	6		
8/2 1130	365	66	9.1	99	172	7.5	/1.52[c]		5.6/0.24		0.0/0.00	94/1.54		1.5/0.04			0.3			101[e]	14	76	0	2		
9/6 1220	500	72	8.4	97	176	7.7	20/1.00	6.8/0.56	6.4/0.28	0.9/0.02	0.0/0.00	94/1.54	8.0/0.17	5.0/0.14	1.5/0.02	0.0/0.00	0.3	9.3	Fe 0.12 Mn 0.32[d] PO_4 0.20 Zn 0.08	104[f]	15	78	1	2		
10/3 1100	381	66	8.5	93	174	7.6	/1.56[c]		5.2/0.23		0.0/0.00	96/1.57		3.5/0.10			0.3			102[g]	13	78	0	10		
11/10 1230	220	54	10.3	97	188	7.5	/1.62[c]		6.1/0.27		0.0/0.00	101/1.66		3.0/0.08			0.3			111[e]	14	81	0	5		
12/12 1715	205	50	7.8	70	201	7.3	/1.86[c]		8.1/0.35		0.0/0.00	112/1.84		5.5/0.16			0.6			119[e]	16	93	1	11		

a Field pH

b Laboratory pH.

c Sum of calcium and magnesium in epm.

d Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and hexavalent chromium (Cr^{+6}), reported here as $\frac{0.0}{0.00}$ except as shown.

e Derived from conductivity vs TDS curves

f Determined by addition of analyzed constituents.

g Gravimetric determination.

h Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by California Department of Public Health, Division of Laboratories, or United States Public Health Service.

i Mineral analyses made by United States Geological Survey, Quality of Water Branch (USGS); United States Department of the Interior, Bureau of Reclamation (USBR); United States Public Health Service (USPHS); San Bernardino County Flood Control District (SBCFCD); Metropolitan Water District of Southern California (MWD); Los Angeles Department of Water and Power (LADWP); City of Los Angeles, Department of Public Health (LADPH); City of Long Beach, Department of Public Health (LBDPH); Terminal Testing Laboratories, Inc. (TTL); or California Department of Water Resources (DWR); as indicated.

ANALYSES OF SURFACE WATER

NORTH COASTAL REGION (1)

RUSSIAN RIVER NEAR HOPLAND

Date and time sampled PST	Discharge in cfs	Temp in °F	Dissolved oxygen ppm (a = 0.98)	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH a	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity in ppm	Coliform[h] MPN/ml	Analyzed by[i]
							Mineral constituents in parts per million / equivalents per million																			
1962																										
1/9 1640	180	52	10.9	99	203	7.2	1.76[c]		8.7 / 0.38		0 / 0.00	105 / 1.72		6.5 / 0.18			0.4			120[e]	18	88	2	9	Median 50	USGS
2/15 1310	6840	53	9.7	91	93	6.8	0.74[c]		4.4 / 0.19		0 / 0.00	42 / 0.69		4.0 / 0.11			0.0			55[a]	20	37	3	15	Max. 2400.	
3/8 1130	4260	48	10.3	90	135	7.3	1.18[c]		5.4 / 0.23		0 / 0.00	67 / 1.10		3.8 / 0.11			0.2			80[e]	16	59	4	90	Min. 0.23	
4/11 1730	685	55	9.3	89	153	7.4	1.30[c]		5.9 / 0.26		0 / 0.00	78 / 1.28		6.0 / 0.17			0.0			90[e]	17	65	1	40		
5/10 1203	133	60	12.0	122	217	7.9	21 / 1.05	9.4 / 0.77	9.6 / 0.42	1.3 / 0.03	0 / 0.00	111 / 1.82	8.0 / 0.17	5.0 / 0.14	3.2 / 0.05	0.1 / 0.01	0.3	13	PO_4 0.35	126[f]	19	91	0	6		
6/7 0935	135	67	10.4	114	197	7.5	1.84[c]		9.7 / 0.42		0 / 0.00	101 / 1.66		4.5 / 0.13			0.2			116[e]	19	92	9	4		
7/10 1637	155	68	10.8	120	171	7.6	1.48[c]		6.6 / 0.29		0 / 0.00	90 / 1.48		3.8 / 0.11			0.3			101[e]	16	74	0	1		
8/9 1020	239	58	7.9	78	177	7.4	1.60[c]		7.7 / 0.33		0 / 0.00	98 / 1.61		5.8 / 0.16			0.3			104[a]	17	80	0	5		
9/13 1347	209	64	9.8	104	177	7.2	20 / 1.00	7.3 / 0.60	6.3 / 0.27	0.7 / 0.02	0 / 0.00	98 / 1.61	8.0 / 0.17	3.0 / 0.08	1.1 / 0.02	0.0 / 0.00	0.2	9.3	PO_4 0.10	104[g]	14	80	0	7		

a Field pH

b Laboratory pH

c Sum of calcium and magnesium in epm.

d Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and hexavalent chromium (Cr^{+6}), reported here as $\frac{0.0}{0.00}$ except as shown.

e Derived from conductivity vs TDS curves. f = 0.590

f Determined by addition of analyzed constituents.

g Gravimetric determination.

h Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by California Department of Public Health, Division of Laboratories, or United States Public Health Service

i Mineral analyses made by United States Geological Survey, Quality of Water Branch (USGS); United States Department of the Interior, Bureau of Reclamation (USBR); United States Public Health Service (USPHS); San Bernardino County Flood Control District (SBCFCD); Metropolitan Water District of Southern California (MWD); Los Angeles Department of Water and Power (LADWP); City of Los Angeles, Department of Public Health (LADPH); City of Long Beach, Department of Public Health (LBDPH); Terminal Testing Laboratories, Inc. (TTL); or California Department of Water Resources (DWR); as indicated.

ANALYSES OF SURFACE WATER

NORTH COASTAL REGION (NO. 1)

Date and time sampled P.S.T.	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH a/b	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity in ppm	Coliform MPN/ml	Analyzed by
							Mineral constituents in parts per million / equivalents per million																			
RUSSIAN RIVER NEAR HOPLAND																										
10-10-62 1335	236	66	9.4	102	190	7.5/7.4		/1.62[c]	8.9/0.39		0/0.00	103/1.69		6.9/0.19			0.3			112[e]	19	81	0	7	62. 21.	USGS
11-15-62 1315	345	56	10.0	97	177	7.4/7.7		/1.54[c]	6.7/0.29		0/0.00	102/1.67		4.0/0.11			0.6			104[e]	16	77	0	15	50. 13.	
12-12-62 1030	900	52	9.8	90	164	7.3/7.7		/1.42[c]	7.2/0.31		0/0.00	90/1.48		3.6/0.10			0.3			96[e]	18	71	0	25	62. 2,400.	
1-4-63 1215	124	51	10.6	96	243	7.3/7.7		/2.10[c]	11/0.48		0/0.00	130/2.13		7.8/0.22			0.4			143[e]	19	105	0	5	2.3 2.3	
2-13-63 1035	1,300	54	9.8	93	157	7.2/7.4		/1.34[c]	6.4/0.28		0/0.00	84/1.38		3.5/0.10			0.4			92[e]	17	67	0	50	62. 230.	
3-13-63 1130	468	53	10.8	101	181	7.2/7.6		/1.54[c]	6.7/0.29		0/0.00	93/1.52		5.0/0.14			0.3			106[e]	16	77	1	50	620. 230.	
4-11-63 1330	3,820	52	10.4	96	148	7.6/7.8		/1.28[c]	5.2/0.23		0/0.00	80/1.31		3.5/0.10			0.1			87[e]	15	64	0	50	230. 23.	
5-8-63 0735	527	53	9.6	89	194	7.3/7.6	21/1.05	8.1/0.67	7.1/0.31	1.2/0.03	0/0.00	106/1.74	9.0/0.19	3.0/0.08	2.0/0.03	0.1/0.01	0.2	13	PO_4 = 0.10	118[g]	15	86	0	25	230. 620.	
6-11-63 1000	156	68	10.2	113	200	8./8.3		/1.78[c]	6.8/0.30		3/0.10	108/1.77		4.4/0.12			0.3			118[e]	14	89	0	10	62. 5.	
7-9-63 1120	185	66	10.5	114	193	7.6/7.8		/1.76[c]	7.0/0.30		0/0.00	106/1.74		4.5/0.13			0.2			113[e]	15	88	1	10	62. 13.	
8-6-63 0945	163	66	10.5	114	182	7./8.0		/1.61[c]	6.6/0.29		0/0.00	98/1.61		5.0/0.14			0.0			107[e]	15	80	0	2	6.2 6.2	
9-11-63 1410	244	68	10.0	111	199	7.7/7.9	19/0.95	7.7/0.63	5.7/0.25	0.9/0.02	0/0.00	96/1.57	7.0/0.15	3.0/0.08	1.3/0.02	0.1/0.01	0.1	12	As = 0.00 ABS = 0.0 PO_4 = 0.25	104[g]	14	79	0	4	23. 13.	

a Field pH.

b Laboratory pH.

c Sum of calcium and magnesium in epm.

d Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and hexavalent chromium (Cr^{+6}), reported here as $\frac{0.0}{0.00}$ except as shown.

e Derived from conductivity vs TDS curves.

f Determined by addition of analyzed constituents.

g Gravimetric determination.

h Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by California Department of Public Health, Division of Laboratories, or United States Public Health Service

i Mineral analyses made by United States Geological Survey, Quality of Water Branch (USGS); United States Department of the Interior, Bureau of Reclamation (USBR); United States Public Health Service (USPHS); San Bernardino County Flood Control District (SBCFCD); Metropolitan Water District of Southern California (MWD); Los Angeles Department of Water and Power (LADWP); City of Los Angeles, Department of Public Health (LADPH); City of Long Beach, Department of Public Health (LBDPH); Terminal Testing Laboratories, Inc. (TTL); or California Department of Water Resources (DWR); as indicated.

ANALYSES OF SURFACE WATER

NORTH COASTAL REGION (NO. 1)

Mineral constituents in parts per million / equivalents per million

Date and time sampled P.S.T.	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH [a] / [b]	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity in ppm	Coliform[h] MPN/ml	Analyzed by[i]
RUSSIAN RIVER NEAR HOPLAND																										
10-10-63 1325	236	62	9.2	96	181	7.9 / 7.6		1.62[c]	5.6 / 0.24		0 / 0.00	100 / 1.64		4.9 / 0.14			0.1				13	81	0	2	2.3 6.2	USGS
11-13-63 1230	435	61	9.3	96	196	7.4 / 7.7		1.72[c]	6.8 / 0.30		0 / 0.00	105 / 1.72		5.8 / 0.16			0.4				15	86	0	7	23.	
12-13-63 1100	181	47	10.5	90	227	7.2 / 7.8		1.92[c]	8.9 / 0.39		0 / 0.00	119 / 1.95		6.7 / 0.19			0.4				17	96	0	10	23. 6.2	
1-8-64 1115	1,880	48	11.6	101	178	7.2 / 7.7		1.60[c]	6.6 / 0.29		0 / 0.00	97 / 1.59		4.5 / 0.13			0.3				15	80	0	30	23. 6.2	
2-5-64 1200	400	51	9.6	87	218	7.3 / 7.8		1.86[c]	9.0 / 0.39		0 / 0.00	112 / 1.84		6.2 / 0.17			0.1				17	93	1	6	230. 23.	
3-11-64 1400	527	47	11.3	97	185	7.4 / 7.7		1.63[c]	7.4 / 0.32		0 / 0.00	97 / 1.59		5.8 / 0.16			0.2				16	82	2	15	6.2 2.3	
4-15-64 1145	158	63	11.0	116	216	7.6 / 8.3		1.92[c]	8.7 / 0.38		1 / 0.03	115 / 1.88		7.0 / 0.20			0.3				17	96	0	3	23. 23.	
5-12-64 0930	122	64	9.5	98	223	7.4 / 8.1	24 / 1.20	9.2 / 0.76	9.6 / 0.42	0.8 / 0.02	0 / 0.00	120 / 1.97	9.0 / 0.19	10 / 0.28	1.9 / 0.03	0.3 / 0.02	0.4	9.4	As = 0.00 ABS = 0.1 PO_4 = 0.35	135	18	98	0	1	620. 230.	
6-3-64 0955	146	59	10.1	101	200	7.4 / 7.4		1.78[c]	7.6 / 0.33		0 / 0.00	106 / 1.74		3.5 / 0.10			0.3				16	89	2	4	23. 62.	
7-15-64 0900	219	65	9.8	105	191	7.4 / 7.6		1.72[c]	7.2 / 0.31		0 / 0.00	102 / 1.67		3.0 / 0.08			0.3				15	86	2	4	23 23	
8-11-64 1045	211	65	9.7	104	198	8.1 / 8.0		1.76[c]	7.6 / 0.33		0 / 0.00	108 / 1.77		3.5 / 0.10			0.4				16	88	0	1	23. 2 3	
9-2-64 1030	241	65	8.5	91	208	7.7 / 7.6	25 / 1.25	7.7 / 0.63	7.8 / 0.34	0.8 / 0.02	0 / 0.00	116 / 1.90	9.0 / 0.19	3.6 / 0.10	0.8 / 0.01		0.4	7.0	As = 0.00 ABS = 0.1 PO_4 = 0.05	120	15	94	0	1	2 3 6 2	

a Field pH

b Laboratory pH

c Sum of calcium and magnesium in epm.

d Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and hexavalent chromium (Cr^{+6}), reported here as $\frac{0.0}{0.00}$ except as shown.

e Derived from conductivity vs TDS curves

f Determined by addition of analyzed constituents.

g Gravimetric determination.

h Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by California Department of Public Health, Division of Laboratories, or United States Public Health Service

i Mineral analyses made by United States Geological Survey, Quality of Water Branch (USGS); United States Department of the Interior, Bureau of Reclamation (USBR); United States Public Health Service (USPHS), San Bernardino County Flood Control District (SBCFCD); Metropolitan Water District of Southern California (MWD); Los Angeles Department of Water and Power (LADWP), City of Los Angeles, Department of Public Health (LADPH), City of Long Beach, Department of Public Health (LBDPH); Terminal Testing Laboratories, Inc. (TTL); or California Department of Water Resources (DWR); as indicated.

ANALYSES OF SURFACE WATER

Date and time sampled P.S.T.	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH a/b	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity a/b	Coliform[c] MPN/ml	Analyzed by[d]
							Mineral constituents in parts per million / equivalents per million																			
NORTH COASTAL REGION (NO. 1)																										
RUSSIAN RIVER NEAR HOPLAND (STA. 8.0)																										
10-16-64 0745	233	61	7.7	79	212	7.4 / 7.8		— / 1.84[e]	8.4 / 0.37		0 / 0.00	118 / 1.93		4.2 / 0.12			0.4				17	92	0	— / 2	62. / 620.	USGS

a Field determination.

b Laboratory analysis.

c Analyzed by California Department of Public Health, Division of Laboratories.

d Mineral analyses made by United States Geological Survey, Water Resources Division (USGS) or California Department of Water Resources (DWR) as indicated.

e Sum of calcium and magnesium in epm.

ANALYSES OF SURFACE WATER

Date and time sampled P.S.T.	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH a/b	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity a/b	Coliform[c] MPN/ml	Analyzed by[d]
							Mineral constituents in parts per million / equivalents per million																			
NORTH COASTAL REGION (NO. 1)																										
RUSSIAN RIVER NEAR HOPLAND (Cont.)																										
11-10-64 0810	2,520	51	9.0	82	141	7.2/7.0		/1.14[e]	6.5/0.28		0/0.00	60/0.98		4.4/0.12			0.3				20	57	8	/400	2,400. 2,400.	USGS
12-2-64 1230	1,280	55	9.5	91	137	7.4/7.9		/1.12[e]	6.2/0.27		0/0.00	66/1.08		2.8/0.08			0.2				19	56	2	/75	62. 620.	
1-6-65 1015	6,800	49	10.2	90	105	7.2/7.5		/0.84[e]	6.8/0.30		0/0.00	52/0.85		2.4/0.07			0.1				26	42	0	/800	62. 62.	
2-3-65 1000	1,740	43	11.4	93	155	7.4/7.6		/1.38[e]	5.7/0.25		0/0.00	79/1.29		2.6/0.07			0.1				15	69	4	/200	130. 620.	
3-12-65 0935	167	53	9.6	89	206	7.2/7.8		/1.82[e]	7.6/0.33		0/0.00	110/1.80		3.9/0.11			0.3				15	91	1	/60	23. 62.	
4-14-65 1050	470	51	10.1	92	184	7.6/7.4		/1.60[e]	7.2/0.31		0/0.00	94/1.54		3.8/0.11			0.2				16	80	3	/80	23. 230.	
5-12-65 0905	693	57	10.0	98	188	7.4/8.4	19/0.95	8.4/0.69	6.6/0.29	1.5/0.04	2/0.07	93/1.52	9.0/0.19	3.7/0.10	2.2/0.04		0.2	12	As = 0.00 ABS = 0.1 PO_4 = 0.15	125	15	82	2	/40	62. 130.	
6-2-65 1130	314	65	7.8	84	189	7.6/8.2		/1.72[e]	7.2/0.31		0/0.00	101/1.66		3.7/0.10			0.3				15	86	3	/35	6.2 23.	

a Field determination.

b Laboratory analysis.

c Analyzed by California Department of Public Health, Division of Laboratories.

d Mineral analyses made by United States Geological Survey, Water Resources Division (USGS) or California Department of Water Resources (DWR) as indicated.

e Sum of calcium and magnesium in epm.

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

McNAB CREEK (STATION 29)
14N/12W-26Q

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents[b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hach / Hellige	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																		
7-7-65 1120	1/2	69.5	8.55	94.9	301	7.6 / 8.3	22 / 1.10	17 / 1.42	11 / 0.48	0.9 / 0.02	0 / 0.00	138 / 2.26	17 / 0.35	9.7 / 0.27	5.5 / 0.09	0.1 / 0.00	0.4		PO_4 = 0.08 Fe = 0.10 Color = 0	148	16	126	13	< 5	DWR
9-28-65 0935	1/4	59	9.0	88.8	255	7.5 / 8.3	2.20[c]				0 / 0.00	123 / 2.02		6.9 / 0.19	3.7 / 0.06				PO_4 = 0.08			110	9	< 5	DWR
12-15-65 0900	1.5	43	10.9	87.5	252	7.3 / 8.2	2.16[c]				0 / 0.00	113 / 1.85		8.0 / 0.22	8.0 / 0.13				PO_4 = 0.10			108	15	< 5	DWR
1-18-66 1250	2.5	50	11.1	98.0	223	7.3 / 7.9	1.90[c]				0 / 0.00	104 / 1.70		5.7 / 0.16	5.5 / 0.09				PO_4 = 0.07			95	10	< 5	DWR
3-1-66 0945	5	48	11.9	102	203	7.3 / 8.3	24	4.9			0 / 0.00	102 / 1.67		4.1 / 0.12	2.9 / 0.05		0.2			118		80	0	7	DWR
4-12-66 1220	4	59	10.9	108	235	8.2 /	2.08[c]					122		5.7 / 0.16	2.9 / 0.05				PO_4 = 0.04 (Ortho)			104		2	DWR
5-11-66 1435	1 1/2	67	12.5	135	235	8.5 /						134		7.6 / 0.21	7.7 / 0.12				PO_4 = 0.05 (Ortho)					< 5 / 1.7	DWR
6-8-66 1350	1	68	12.1	132	270	8.3 /	2.12[c]					134		7.5 / 0.21	6.7 / 0.11				PO_4 = 0.09 (Ortho)			106		70 / 11.2	DWR
7-20-66 1305	1/2	73	10.5	121	300	8.0 /						153												< 5 / 0.7	Field Determination
8-17-66 1445	1/2	80	8.5	105	285	7.9 /						146		8.6 / 0.24	8.4 / 0.14				PO_4 = 0.10 (Ortho) Fe = 0.08 Mn = 0.00	166				< 5 / 0.7	DWR

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hach turbidity in Jackson Turbidity Units using Hach Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

ROBINSON CREEK (STATION 30)
14N/12W-4M

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents[b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hach / Hellige	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																		
7-7-65 1150	1/2	85.5	9.3	121	256	8.3 / 8.3	30 / 1.50	12 / 0.98	8.5 / 0.37	1.3 / 0.03	0 / 0.00	149 / 2.44	10 / 0.21	5.8 / 0.16	0.5 / 0.01	0.1 / 0.00	0.2		PO_4 = 0.09 Fe = 0.27 Color = 0	136	13	124	2	< 5	DWR
12-15-65 0830	2	39	12.2	92.5	255	7.7 / 8.3					0 / 0.00	126 / 2.06		6.8 / 0.19	1.3 / 0.02				PO_4 = 0.05					< 5	DWR
1-18-66 1220	15	49	11.5	100	216	7.5 / 7.9	/ 1.88[c]				0 / 0.00	107 / 1.75		5.0 / 0.14	1.6 / 0.02				PO_4 = 0.06			94	6	5	DWR
3-1-66 0920	30	46	11.9	99.7	184	7.5 / 8.5	25	2.6			4 / 0.13	88 / 1.44		2.4 / 0.07	0.7 / 0.01		0.1			107		73	0	11	DWR
4-12-66 1203	25	57	11.0	106	210	8.2	/ 1.74[c]					122		4.4 / 0.12	0.4 / 0.01				PO_4 = 0.07 (Ortho)			87		20	DWR
5-12-66 0940	5	62	10.3	105	225	7.8						134		4.5 / 0.13	0.3 / 0.00				PO_4 = 0.04 (Ortho)					< 5 / 0.5	DWR
6-8-66 1055	2	74	11.7	136	240	8.5	/ 2.02[c]					153		3.9 / 0.11	0.7 / 0.01				PO_4 = 0.04 (Ortho)			101		< 5 / 0.5	DWR

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hach turbidity in Jackson Turbidity Units using Hach Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

SULPHUR CREEK BELOW VICHY SPRINGS (STATION 31)
15N/12W-16G

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen % Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents [b]	Total dissolved solids[c] in ppm	Per cent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hach / Hellige	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																		
7-8-65 1315	3/4	90	9.1	123	1090	8.8 / 8.7	10 / 0.50	16 / 1.32	228 / 9.92	10 / 0.26	70 / 2.33	474 / 7.77	14 / 0.29	51 / 1.44	1.1 / 0.02	0.4	24		PO_4 = 0.11 Fe = 5.3	769	83	91	0	8	DWR
9-28-65 0830	1	56	9.5	90.5	1730	8.5 / 8.7	2.86[c]				99 / 3.30	741 / 12.14		107 / 3.02	0.9 / 0.01		49		PO_4 = 0.13 Fe = 0.31			143	0		DWR
10-26-65 0735	3/4	54	9.7	90.1	1750	8.5	19.2 / 0.96	27.2 / 2.24				1070										160		< 5	Field Determination
12-14-65 1425	1.5	52	11.6	105	1550	8.4 / 8.6	2.54[c]				37 / 1.23	520 / 8.52		53 / 1.50	1.9 / 0.03		26		PO_4 = 0.06			127	0	< 5	DWR
1-18-66 1145	6	45	11.9	98.3	724	8.5 / 8.5	2.88[c]				14 / 0.47	371 / 6.08		26 / 0.73	1.6 / 0.02		12		PO_4 = 0.17			144	0	< 5	DWR
3-1-66 0810	10	42	12.9	102	417	8.5 / 8.5	28 / 1.40	8.8 / 0.72			10 / 0.33	215 / 3.52		12 / 0.34	0.7 / 0.01		5.0			248		106	0	12	DWR
4-12-66 1040	10	60	10.9	109	540	8.5 / 8.7	2.70[c]				16 / 0.53	281 / 4.60		16 / 0.45	0.4 / 0.01		7		PO_4 = 0.11 (Ortho)			135	0	3.1	DWR
5-12-66 1000	3	62	10.9	111	800	8.5 / 8.5	2.24[c]				6 / 0.20	470 / 7.70		33 / 0.93	0.8 / 0.01		17		PO_4 = 0.13 (Ortho)			112	0	< 5 / 0.8	DWR
6-8-66 1315	1	82	9.9	123	900	8.8 / 8.5	1.58[c]				23 / 0.77	461 / 7.56		42 / 1.18	0.8 / 0.01		21		PO_4 = 0.08 (Ortho)			79	0	< 5 / 0.8	DWR
7-20-66 1205	1/2	83	10.8	135	960	8.7 / 8.7	2.08[c]		202 / 8.79	7.6 / 0.19	44 / 1.47	479 / 7.85		56 / 1.58	0.5 / 0.01		24		Fe = 0.29 Mn = 0.05		79	104	0	< 5 / 0.7	DWR
8-17-66 1330	1/4	89	9.8	133	1050	8.8					72	671		73 / 2.06	0.5 / 0.01		26		PO_4 = 0.13 (Ortho) Fe = 0.07 Mn = 0.04	750				< 5 / 1.4	DWR

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hach turbidity in Jackson Turbidity Units using Hach Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

SULPHUR CREEK ABOVE VICHY SPRINGS (STATION 32)
15N/12W-14D

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents [b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity[d] in ppm Hoch / Hellige	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																		
7-8-65 1345	1/2	88	7.3	97.2	523	7.9 / 8.4	50 / 2.50	13 / 1.08	42 / 1.83	3.7 / 0.09	2 / 0.07	289 / 4.74	22 / 0.46	10 / 0.28	0.0 / 0.00	0.3 / 0.02	3.0		PO_4 = 0.35 Fe = 6.7	304	32	179	0		DWR
9-28-65 0855	3/4	61.5	10.0	102	710	7.9 / 8.5	2.52[c]				9 / 0.30	248 / 4.06		16 / 0.45	0.3 / 0.00		5.6		PO_4 = 0.10 Fe = 0.02			126	0	< 5	DWR
10-26-65 0805	1/2	56	9.1	86.7	705	8.1	76.2 / 3.80	14.6 / 1.20			0 / 0.00	403 / 6.61										250	0	< 5	Field Determination
12-14-65 1445	1	46	10.8	90.5	445	8.1 / 8.4	3.74[c]				4 / 0.13	245 / 4.02		8.7 / 0.24	0.1 / 0.00		1.7					187	0	< 5	DWR
1-18-66 1105	5	43	12.5	100	331	8.1 / 8.3	2.80[c]				0 / 0.00	183 / 3.00		5.7 / 0.16	0.0 / 0.00				PO_4 = 0.10			140	0	< 5	DWR
3-1-66 0840	8	43	12.5	100	231	7.5 / 8.5	29 / 1.45	6.7 / 0.55			3 / 0.10	125 / 2.05		4.0 / 0.11	0.4 / 0.01		0.3			133		100	0	12	DWR
4-12-66 1100	3	56	10.9	104	315	8.2 / 8.3	2.70[c]					175 / 2.87	0 / 0.00	3.9 / 0.11	0.5 / 0.01		0.4		PO_4 = 0.11 (Ortho)			135	0	3.6	DWR
5-12-66 1025	2	66	9.9	106	490	8.1 / 8.3	3.34[c]				0 / 0.00	255 / 4.18		6.7 / 0.19	0.4 / 0.01		1.4		PO_4 = 0.13 (Ortho)			167	0	< 5 / 0.8	DWR
6-8-66 1250	1	79	10.6	130	450	8.5 / 8.3	2.88[c]				0 / 0.00	234 / 3.84		7.7 / 0.22	0.7 / 0.01		2.2		PO_4 = 0.08 (Ortho)			144	0	< 5 / 0.7	DWR
7-20-66 1230	1/2	85	10.0	130	570	8.3 / 8.3	3.84[c]		61 / 2.65	3.2 / 0.08	0 / 0.00	337 / 5.52		14 / 0.39	0.6 / 0.01		5.6		Fe = 0.91 Mn = 0.08			192	0	< 5 / 1.1	DWR
8-17-66 1350	1/4	87	7.3	96.4	700	8.1						464		24 / 0.68	0.6 / 0.01		9.9		PO_4 = 0.07 (Ortho) Fe = 0.08 Mn = 0.00	426				< 5 / 0.25	DWR

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hach turbidity in Jackson Turbidity Units using Hach Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

ORRS CREEK (STATION 33)
15N/12W-16L

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents [b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hach / Hellige	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																		
12-14-65 1515	1.5	48	10.9	93.8	265	7.4 / 8.2	/ 2.26[c]				0 / 0.00	123 / 2.02		8.5 / 0.24	1.7 / 0.03				PO_4 = 0.03			113	12	< 5 /	DWR
1-18-66 1040	4	44	11.6	94.4	321	7.1 / 8.3	/ 2.52[c]				0 / 0.00	164 / 2.69		14 / 0.39	0.8 / 0.01				PO_4 = 0.46			126	0	< 5 /	DWR
3-1-66 0900	8	45	12.2	101	158	7.3 / 7.9	20 /	3.2 /			0 / 0.00	76 / 1.24		2.4 / 0.07	0.8 / 0.01		0.1 /			96		63	1	14 /	DWR
4-12-66 1022	5	56	11.0	105	171	7.6 /	/ 1.44[c]					92 /		3.8 / 0.11	0.5 / 0.01				PO_4 = 0.07 (Ortho)			72		34.5 /	DWR
5-12-66 1045	1	65	9.7	103	210	7.3 /						116 /		6.0 / 0.17	1.7 / 0.03				PO_4 = 0.14 (Ortho)					< 5 / 0.8	DWR

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hach turbidity in Jackson Turbidity Units using Hach Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

EAST FORK RUSSIAN RIVER BELOW LAKE MENDOCINO (STATION 34)

16N/12W-34M

Mineral constituents in parts per million / equivalents per million

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents[b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hach / Hellige	Analyzed by[e]
7-8-65 1140	177	60	10.8	108	164	7.3 / 8.2	18 / 0.90	6.8 / 0.56	5.0 / 0.22	1.2 / 0.02	0 / 0.00	87 / 1.43	7.1 / 0.15	2.3 / 0.06	1.0 / 0.02	0.1 / 0.00	0.2 /		PO_4 = 0.16 Fe = 3.5 Color = 30	115	13	73	2	50 /	DWR
9-27-65 1400	258	65	8.5	89.8	175	7.3 / 8.2	/ 1.64[c]				0 / 0.00	97 / 1.59		2.9 / 0.08	1.6 / 0.02				PO_4 = 0.07 Fe = 0.21			82	2	< 5 /	DWR
10-25-65 1450	244	68	9.1	99.5	210	8.2 /						120 / 1.97												7 /	Field Determination
12-14-65 1350	310	52	10.8	97.8	204	7.7 / 8.2	/ 1.82[c]				0 / 0.00	107 / 1.75		4.6 / 0.13	0.9 / 0.01				PO_4 = 0.11 Fe = 0.00			91	3	29 /	DWR
1-18-66 1000	8.8	42	11.5	91.1	140	7.3 / 7.6	/ 1.22[c]				0 / 0.00	71 / 1.16		2.6 / 0.07	2.3 / 0.04				PO_4 = 0.27			61	3	375 /	DWR
2-28-66 1510	16	48	12.5	108	163	7.5 / 8.3	18 / 0.90	6.8 / 0.56			0 / 0.00	87 / 1.42		2.5 / 0.07	1.1 / 0.02		0.1 /			104		73	2	98 /	DWR
4-12-66 0910	162	50	12.2	108	172	7.9 /	/ 1.46[c]					98 /		2.4 / 0.07	1.1 / 0.02				PO_4 = 0.11 (Ortho)			73		50 /	DWR
5-11-66 1405	398	54	12.2	113	160	7.5 /						98 /		2.3 / 0.06	0.8 / 0.01				PO_4 = 0.10 (Ortho)					100 / 30	DWR
6-7-66 1405	168	54	11.5	107	180	7.3 /	/ 1.56[c]					104 /		2.0 / 0.06	1.1 / 0.02				PO_4 = 0.09 (Ortho) Fe = 1.1			78		20 / 21.5	DWR
7-20-66 1115	234	59	10.4	103	180	7.3 /						116 /							Fe = 1.0 Mn = 0.47					49 / 19.6	DWR
8-16-66 1300	240	64	9.5	99.3	180	7.3 /						104 /		2.9 / 0.08	0.6 / 0.01		0.2 /		PO_4 = 0.06 (Ortho) Fe = 0.16 Mn = 0.32	104				< 5 / 1.7	DWR

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hach turbidity in Jackson Turbidity Units using Hach Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

EAST FORK RUSSIAN RIVER ABOVE LAKE MENDOCINO (STATION 35)
16N/12W-13H

Mineral constituents in parts per million / equivalents per million

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25° C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents [b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity[d] in ppm Hoch / Hellige	Analyzed by[e]
7-8-65 1040	188	70	9.3	104	167	7.8 / 8.2	20 / 1.00	6.6 / 0.54	4.8 / 0.21	0.8 / 0.02	0 / 0.00	91 / 1.49	6.6 / 0.14	2.0 / 0.06	0.6 / 0.01	0.2	0.2		PO_4 = 0.11 Fe = 2.0 Color = 5	109	12	77	2	20	DWR
9-27-65 1320	290	64.5	9.2	96.7	210	8.0 / 8.2	1.88[c]				0 / 0.00	110 / 1.80		3.2 / 0.09	0.4 / 0.01				PO_4 = 0.06 Fe = 0.58			94	4	< 5	DWR
10-25-65 1410	335	67.5	9.4	102	225	8.3						122 / 2.00												6	Field Determination
12-14-65 1140	192	45	11.9	98.3	235	7.7 / 8.2	2.04[c]				0 / 0.00	122 / 2.00		5.8 / 0.16	1.0 / 0.02				PO_4 = 0.12 Fe = 0.01			102	2	37	DWR
1-17-66 1550	368	45	12.5	103	163	8.1 / 8.0	1.42[c]				0 / 0.00	84 / 1.38		2.7 / 0.08	1.2 / 0.02				PO_4 = 0.19			71	2	195	DWR
2-28-66 1425	445	48	12.3	106	173	8.3 / 8.3	20 / 1.00	6.6 / 0.54				93 / 1.52		2.1 / 0.06	0.3 / 0.00		0.2			105		77	1	78	DWR
4-11-66 1430	380	54	11.1	103.1	180	8.1	1.58[c]					110		2.5 / 0.07	1.0 / 0.02				PO_4 = 0.21 (Ortho)			79		89	DWR
5-11-66 1215	358	60	10.7	107	150	8.0						92		2.1 / 0.06	0.8 / 0.01				PO_4 = 0.14 (Ortho)					30 / 30	DWR
6-7-66 1115	115	63	10.5	109	190	8.2	1.54[c]					116		2.0 / 0.06	0.8 / 0.01				PO_4 = 0.10 (Ortho) Fe = 0.73			77		5 / 5.7	DWR
7-19-66 1445	193	72	9.4	107	170	8.4						98							Fe = 0.91 Mn = 0.14					29 / 6.9	DWR
8-16-66 1130	188	69	9.2	102	170	8.1						98		2.3 / 0.06	0.5 / 0.01				PO_4 = 0.11 (Ortho) Fe = 0.45 Mn = 0.08	100				< 5 / 3.7	DWR

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hoch turbidity in Jackson Turbidity Units using Hoch Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

COLD CREEK (STATION 36)
16N/11W-18D

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field	pH Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents[b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hach	Turbidity[d] in ppm Hellige	Analyzed by[e]
7-8-65 0900	5	62	9.9	101	327	7.8	8.5	36 / 1.80	15 / 1.24	8.0 / 0.35	1.0 / 0.02	6.0 / 0.20	170 / 2.79	9.7 / 0.20	4.1 / 0.12	0.5 / 0.01	0.1 / 0.00	0.0		PO_4 = 0.02 Fe = 0.29 Color = 0	186	10	152	3	< 5		DWR
9-27-65 1305	4	59	10.5	104	315	8.3	8.5	3.06[c]				6.0 / 0.20	169 / 2.77		4.5 / 0.13	0.9 / 0.01				PO_4 = 0.03 Fe = 0.12			153	5	< 5		DWR
10-25-65 1355	3	65	9.2	97.2	325	8.2						0 / 0.00	183 / 3.00												< 5		Field Determination
12-14-65 1115	8	50	10.6	93.6	310	8.1		3.02[c]				0 / 0.00	180 / 2.95		5.0 / 0.14	1.6 / 0.02				PO_4 = 0.03 Fe = 0.00			151	3	< 5		DWR
1-17-66 1520	8	54	10.4	96.6	290	8.3		2.72[c]				2.0 / 0.07	158 / 2.59		3.8 / 0.11	1.9 / 0.03				PO_4 = 0.05			136	3	< 5		DWR
2-28-66 1405	10	55	10.6	99.7	267	8.3	8.5	31 / 1.55	12 / 0.99			6 / 0.20	144 / 2.36		3.8 / 0.11	0.5 / 0.01		0.0			152		127	0	8		DWR
4-11-66 1415	10	56	10.6	101	280	8.1		2.82[c]					171		4.2 / 0.12	0.6 / 0.01				PO_4 = 0.04 (Ortho)			141		3.7		DWR
5-11-66 1155	10	62	9.9	101	280	8.1							183		4.1 / 0.12	1.5 / 0.02				PO_4 = 0.05 (Ortho) Fe = 0.05					5	1.5	DWR
6-7-66 1050	8	63	11.6	120	300	8.5		2.84[c]				6.0	201		3.4 / 0.10	0.9 / 0.01				PO_4 = 0.02 (Ortho) Fe = 0.04			142		< 5	0.4	DWR
7-19-66 1430	4	72	9.9	113	300	8.4							195							Fe = 0.02 Mn = 0.01					< 5	0.3	DWR
8-16-66 1110	5	66	11.0	118	300	8.5							195		4.0 / 0.11	0.7 / 0.01				PO_4 = 0.05 (Ortho) Fe = 0.02 Mn = 0.01			174		< 5	0.4	DWR

a Sum of calcium and magnesium in epm
b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)
c Gravimetric determination
d Hach turbidity in Jackson Turbidity Units using Hach Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter
e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

EAST FORK RUSSIAN RIVER AT POTTER VALLEY (STATION 37)
17N/11W-6E

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents [b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity[d] in ppm Hach / Hellige	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																		
7-8-65 0950	215	66	8.8	94.1	145	7.8 /																		14	Field Determination
7-13-65 0930		63	10.0	103	156	7.8 /	/ 1.42[c]		4.9 / 0.21		0.00 / 0.00	84 / 1.38		1.9 / 0.05			0.1				13	71	2	38	USGS
9-14-65 0815	2.60	58	10.2	99.5	194	7.4 / 8.0	25 / 1.25	6.2 / 0.51	6.9 / 0.30	1.3 / 0.03	0 / 0.00	106 / 1.74	9.0 / 0.19	2.7 / 0.08	0.5 / 0.01		0.2		ABS = 0.0 PO_4 = 0.03	116	14	88	1	2	USGS
9-27-65 1235	326	66	8.0	85.5	203	7.8 /																		< 5	Field Determination
10-25-65 1320	321	66	9.0	96.2	220	8.3 /						128 / 2.10												< 5	Field Determination
11-10-65 0925	150	52	9.7	87.9	238	7.7 / 8.4	/ 2.22[c]		7.1 / 0.31		4 / 0.13	129 / 2.11		4.3 / 0.12			0.6				12	111	0	5	USGS
12-14-65 1030	162	45	11.0	99.0	212	7.7 / 8.2	/ 1.90[c]				0 / 0.00	114 / 1.87		4.8 / 0.14	0.8 / 0.01				PO_4 = 0.09 Fe = 0.01			95	1	45	DWR
1-13-66 1000	306	42	12.0	95.0	124	7.5 / 7.7	/ 1.10[c]		5.6 / 0.24		0 / 0.00	65 / 1.07		2.0 / 0.06			0.1				18	55	2	200	USGS
1-17-66 1430	310	45	12.1	99.9	120	8.1 /						73												275	Field Determination
2-28-66 1330	310	47	12.1	103	142	8.1 /						73													Field Determination
3-8-66 0850	303	46	12.1	104	134	7.3 / 8.1	/ 1.22[c]		4.4 / 0.19		0 / 0.00	70 / 1.15		1.3 / 0.04			0.1					61	4		USGS
4-11-66 1310	310	53	11.1	102	138	8.1 /	/ 1.20[c]					85		1.7 / 0.05	0.5 / 0.01				PO_4 = 0.17 (Ortho)			60		77	DWR

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hach turbidity in Jackson Turbidity Units using Hach Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

EAST FORK RUSSIAN RIVER AT POTTER VALLEY (STATION 37)
17N/11W-6E

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field/Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents [b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hoch/Hellige	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																		
5-11-66 1120	310	56	10.4	99	138	7.6/						79/							PO_4 = 0.09 (Ortho)					30/35	DWR
5-16-66 0845	297	52	11.1	104	139	7.5/7.9	17/0.85	4.7/0.39	4.4/0.19	0.9/0.02	0/0.00	74/1.21	7.0/0.15	1.5/0.04	0.3/0.00		0.2	9.2	ABS = 0.0 PO_4 = 0.12 (Ortho) As = 0.00	93	13	62	1	10/	USGS
6-7-66 1010	126	59	9.6	94.8	170	7.7/	/1.14[c]					92/		1.0/0.03	0.7/0.01				PO_4 = 0.07 (Ortho)			57		10/5	DWR
7-21-66 1430		70	11.5	128	147	7.6/8.0	/1.32		4.3/0.19		0/0.00	80/1.31		1.4/0.04			0.0				13	66	0	2/	USGS
7-19-66 1345	223	64	9.8	102	160	7.7/						92/							Fe = 0.34 Mn = 0.09					35/5.7	DWR
8-1-66 1030	221	67	8.1	87.5	158	7.8/						85/		2.3/0.06	0.0/0.00				PO_4 = 0.05 (Ortho) Fe = 0.22 Mn = 0.08	84				< 5/2.7	DWR

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hoch turbidity in Jackson Turbidity Units using Hoch Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

REGION 1

Date and time sampled	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity in ppm	Coliform[d] MPN/ml	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																			
East Fork Russian River at Potter Valley Power House																										
1951 May 16 1545		57	9.8	94	149	7.6	18 / 0.90	5.6 / 0.461	3.6 / 0.157	0.7 / 0.018	0 / 0.00	82 / 1.34	8.4 / 0.175	2.2 / 0.062	0 / 0.00		0.37	12		91c	10	68				USGS

a Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and chromium (Cr), reported here as $\frac{0.0}{0.00}$ except as shown.

b Determined by addition of analysed constituents

c Gravimetric determination.

d Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by Calif. Dept of Public Health, Division of Laboratories.

e Mineral analyses made by USGS, Quality of Water Branch (USGS), Pacific Chemical Consultant (PCC), Metropolitan Water District (MWD), Los Angeles Dept. of Water & Power (LADWP), City of Los Angeles Dept of Pub Health (LADPH), Long Beach Dept of Pub Health (LBDPH) & State Division of Water Resources (DWR), as indicated

ANALYSES OF SURFACE WATER

REGION 1

Date and time sampled	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total Dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity in ppm	Coliform[d] MPN/ml	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																			
									East Fork Russian River at Potter Valley Power House																	
1951																										
Jun 12 1025	286	63	8.4	86	162	7.8					0 / 0.00	89 / 1.46		2.4 / 0.068								68		25		DWR
Jul 10 1630	81	67	8.2	89	168	7.8					0 / 0.00	88 / 1.44		1.0 / 0.028								68		25		DWR
Aug 16 1300	71	67	7.8	84	174	7.8					0 / 0.00	92 / 1.51		6 / 0.17								74		25		DWR
Sep 9 1645	138	71	7.2	81	178	8.0	22 / 1.10	6.3 / 0.518	5.7 / 0.248	0.7 / 0.018	0 / 0.00	102 / 1.67	8.0 / 0.167	3.8 / 0.107	0.18 / 0.003		0.34	9.4		105[b]	13	81	0			USGS
Oct 9 1600	316	65	8.6	91	187	7.4			6.0 / 0.261		0 / 0.00	100 / 1.64		4.2 / 0.118							14	82	0	0		USGS
Nov 13 1605	234	54	9.2	92	201	7.8			7.7 / 0.335		0 / 0.00	109 / 1.79		5.0 / 0.141							16	89	0	10	5.6 0.62–62	USGS
Dec 10 1520	310	46	11.0	91	134	7.3					0 / 0.00	72 / 1.18		3 / 0.085								56		45		DWR
1952																										
Jan 9 1520	308	42	11.4	90	115	7.3					0 / 0.00	62 / 1.02		1 / 0.03								48		65		DWR
Feb 11 1500	302	44	11.2	91	95	7.4			3.1 / 0.135		0 / 0.00	49 / 0.80		1.8 / 0.051							14	42	2	100		USGS
Mar 6 1300	306	46	11.0	92	112	7.4			3.0 / 0.130		0 / 0.00	61 / 1.00		2.0 / 0.056							12	50	0	65		USGS
Apr 21 1500	338	52	11.0	99	122	7.5					0 / 0.00	68 / 1.11		1 / 0.03								56		4		DWR
May 19 1600	310	59	9.2	90	124	7.7	15 / 0.75	3.9 / 0.321	3.7 / 0.161	0.6 / 0.015	0 / 0.00	66 / 1.08	6.3 / 0.131	2.5 / 0.071	0.2 / 0.003	0.2 / 0.011	0.19	15	(a)	74[b]	13	54	0			USGS
Jun 16 1445	323	64	9.0	94	127	7.9					0 / 0.00	71 / 1.16		2 / 0.06								56		2		DWR
Jul 7 1720	92	73	8.6	99	145	8.1					0 / 0.00	73 / 1.20		3 / 0.08								60		1		DWR
Aug 4 1645	300				141	7.8	16 / 0.82				0 / 0.00	77 / 1.26		4 / 0.11	.29 / 0.00							60		3		DWR
Sep 15 1750	170	69	88.7	95	159	8.2					0 / 0.00	88 / 1.44		2.6 / 0.073								72				USGS

a Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and chromium (Cr), reported here as $\frac{0.0}{0.00}$ except as shown.

b Determined by addition of analyzed constituents

c Gravimetric determination.

d Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by Calif. Dept of Public Health, Division of Laboratories

e Mineral analyses made by USGS, Quality of Water Branch (USGS), Pacific Chemical Consultant (PCC), Metropolitan Water District (MWD), Los Angeles Dept of Water & Power (LADWP), City of Los Angeles Dept of Pub Health (LADPH), Long Beach Dept of Pub Health (LBDPH) & State Division of Water Resources (DWR), as indicated

ANALYSES OF SURFACE WATER

REGION 1

Date and time sampled	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness N.C. ppm	Turbidity in ppm	Coliform[d] MPN/ml	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																			
							East Fork Russian River at Potter Valley Power House																			
1952 (continued)																										
Oct 6 1715	179	64	9.1	95	164	7.8	21 / 1.05	4.9 / 0.403	5.8 / 0.252	0.4 / 0.010	0 / 0.00	91 / 1.49	6.1 / 0.127	3.0 / 0.085	0.2 / 0.003	0.1 / 0.005	0.28	7.6	(a)	94[b]	15	73	0			DWR
Nov 3 1410	213	59	10.0	99	178	7.8					0 / 0.00	96 / 1.57		2 / 0.06								78		3	0.62 0.045-6.	DWR
Dec	Not sampled																									
1953																										
Jan 12 1600	7.4	56	10.2	97	177	6.4	15 / 0.75	12 / 0.99	2.8 / 0.122	1.0 / 0.026	0 / 0.00	108 / 1.77		1.0 / 0.028							5	87	0			USGS
Feb 13 1230	305	54	11.4	106	113	7.2	13 / 0.65	4.2 / 0.345	4.5 / 0.196	0.9 / 0.023	0 / 0.00	62 / 1.02		2.2 / 0.062							16	50	0			USGS
Mar 9 1645	305	48	9.4	81	135	7.6	17 / 0.85	4.5 / 0.370	5.8 / 0.252		0 / 0.00	[illegible] / 1.20		2.5 / 0.071			0.50				17	61	1			USGS
Apr 6 1715	308	51	10.9	97	131	7.4	15 / 0.75	5.1 / 0.419	4.5 / 0.196		0 / 0.00	71 / 1.16		2.8 / 0.079			0.21				14	58	0	25		USGS
May 4 1847	335	63	9.6	99	126	7.3	15 / 0.75	4.5 / 0.370	4.1 / 0.178	0.7 / 0.018	0 / 0.00	68 / 1.11	7.0 / 0.146	3.0 / 0.085	0.5 / 0.008	0.1 / 0.005	0.06	10	(a)	78[b]	14	56	0	5		USGS
Jun 8 1750	328	59	9.5	93	144	7.4					0 / 0.00	72 / 1.18		8 / 0.23			0.11				13	62		10		DWR
Jul 6 1730	281	70	9.8	109	133	7.3			4.2 / 0.183		0 / 0.00	76 / 1.25		2 / 0.06			0.17				12	65		8		DWR
Aug 3 1540	287	65	9.7	102	142	7.4	19 / 0.95	4.5 / 0.370	4.1 / 0.178	0.6 / 0.015	0 / 0.00	77 / 1.26		2.5 / 0.071			0.09				12	66	3	2		USGS
Sep 14 1715	312	76	8.4	99	165	7.7	19 / 0.95	5.8 / 0.477	5.8 / 0.252	1.0 / 0.026	0 / 0.00	90 / 1.48	7.1 / 0.148	3.0 / 0.085	0.2 / 0.003	0.1 / 0.00	0.39	9.5	Fe 0.01; Zn 0.01; (a)	96[b]	15	71	0	1		USGS
Oct 5 1715	322	69	9.7	92	169	7.8	20 / 1.00	6.2 / 0.510	5.4 / 0.235	0.5 / 0.013	0 / 0.00	94 / 1.54		3.5 / 0.099			0.32				13	75	0	0		USGS
Nov 2 1450	252	59	10.8	95	171	7.7			6.3 / 0.274		0 / 0.00	98 / 1.61		4 / 0.11			0.4				14	87		4		DWR
Dec 7 1500	314	49	10.8	94	146	7.3	18 / 0.90	4.1 / 0.337	5.8 / 0.252	0.9 / 0.023	0 / 0.00	76 / 1.25		3.0 / 0.085			0.38				17	62	0	31	0.9 0.045-7,000+	USGS

a Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and chromium (Cr), reported here as $\frac{0.0}{0.00}$ except as shown.

b Determined by addition of analysed constituents.

c Gravimetric determination.

d Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by Calif Dept of Public Health, Division of Laboratories

e Mineral analyses made by USGS, Quality of Water Branch (USGS), Pacific Chemical Consultant (PCC), Metropolitan Water District (MWD), Los Angeles Dept of Water & Power (LADWP), City of Los Angeles Dept of Pub Health (LADPH), Long Beach Dept of Pub Health (LBDPH) & State Division of Water Resources (DWR), as indicated

ANALYSES OF SURFACE WATER

REGION 1

Date and time sampled	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total Dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity in ppm	Coliform[d] MPN/ml	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																			
							East Fork Russian River at Potter Valley Power House																			
1954																										
Jan 4 1615	306	48	12.2	105	176	7.5	20 / 1.00	6.1 / 0.502	6.1 / 0.265	0.8 / 0.020	0 / 0.00	92 / 1.51		5.5 / 0.155			0.46				15	75	0	11		
Feb 1 1742	310	48	11.2	96	103	7.4	12 / 0.60	3.2 / 0.263	2.8 / 0.122	1.4 / 0.036	0 / 0.00	55 / 0.90		1.8 / 0.051			0.10				12	43	0	54		
Mar 1 1130	308	52	10.8	98	108	8.4	13 / 0.65	3.7 / 0.304	4.1 / 0.179	0.7 / 0.018	0 / 0.00	57 / 0.93		0.5 / 0.014			0.08				15	48	1	54		
Apr 5 1515	308	54	11.0	102	131	7.6	16 / 0.80	4.4 / 0.362	4.0 / 0.174	1.0 / 0.026	0 / 0.00	69 / 1.13		1.0 / 0.028			0.20				13	58	1	75		[illegible]
May 3 1755	320	56	10.4	99	141	7.3	16 / 0.80	4.0 / 0.329	4.4 / 0.191	0.6 / 0.015	0 / 0.00	68 / 1.11	7.1 / 0.148	1.9 / 0.054	0.1 / 0.002	0.1 / 0.005	0.16	11	Al 0.04; Fe 0.02; Zn 0.10; (a)	79[b]	14	56	1	6		[illegible]
Jun 3 1800	269	59	9.6	95	127	7.4	16 / 0.80	3.5 / 0.288	4.0 / 0.174	0.6 / 0.015	0 / 0.00	68 / 1.11	6.7 / 0.139	2.8 / 0.079			0.15				14	54	0	6		[illegible]
Jul 12 1620	171	73	9.0	103	140	7.6	18 / 0.90	4.7 / 0.387	4.6 / 0.200	0.6 / 0.015	0 / 0.00	77 / 1.26		2.5 / 0.071			0.06				13	64	1	2		USGS
Aug 2 1830	172	69	8.4	93	150	7.4	18 / 0.90	5.1 / 0.419	4.9 / 0.213	1.0 / 0.026	0 / 0.00	80 / 1.31		2.5 / 0.071			0.19				14	66	0	1		USGS
Sep 13 1730	314	70	8.2	91	163	7.5	20 / 1.00	5.4 / 0.442	5.6 / 0.244	0.7 / 0.018	0 / 0.00	89 / 1.46	6.1 / 0.127	3.5 / 0.099	0.4 / 0.006	0.1 / 0.005	0.32	9.0	Cu 0.01; Zn 0.01; As 0.01; (e)	95[b]	14	72	0	0.8		USGS
Oct 4 1530	304	67	9.0	97	171	7.7	20 / 1.00	6.3 / 0.522	5.0 / 0.217	0.7 / 0.018	0 / 0.00	96 / 1.57		3.0 / 0.085			0.28	6.5			12	76	0	2		USGS
Nov 7 1245	11	56	9.2	87	188	7.4	24 / 1.20	7.3 / 0.602	6.4 / 0.278	0.7 / 0.018	0 / 0.00	106 / 1.74		5.5 / 0.155			0.53				13	90	3	1		USGS
Dec 6 1400	234		11.8		112	7.9	13 / 0.65	3.9 / 0.321	4.2 / 0.183	1.6 / 0.041	0 / 0.00	59 / 0.97		1.8 / 0.051			0.44				15	48	0	190	2.3 0.045–130	USGS

a Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and chromium (Cr), reported here as $\frac{0.0}{0.00}$ except as shown.

b Determined by addition of analysed constituents

c Gravimetric determination.

d Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by Calif. Dept of Public Health, Division of Laboratories.

e Mineral analyses made by USGS, Quality of Water Branch (USGS), Pacific Chemical Consultant (PCC), Metropolitan Water District (MWD), Los Angeles Dept. of Water & Power (LADWP), City of Los Angeles Dept of Pub Health (LADPH), Long Beach Dept of Pub Health (LBDPH) & State Division of Water Resources (OWR), as indicated

ANALYSES OF SURFACE WATER

REGION 1

Date and time sampled	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity in ppm	Coliform[d] MPN/ml	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																			
							Russian River, East Fork at Potter Valley Power House																			
1955																										
Jan 3 1900	310	41	13.0	102	141	7.1	17 / 0.848	4.6 / 0.382	4.7 / 0.204	0.9 / 0.023	0 / 0.000	75 / 1.229		3.2 / 0.090			0.32				14	62	0	8		USGS
Feb 7 1430	308	46			147	7.5	18 / 0.898	4.8 / 0.392	5.5 / 0.239	0.6 / 0.015	0 / 0.000	78 / 1.278		3.5 / 0.099			0.24				15	64	0	9		USGS
Mar 1 1500	322	43	12.4	100	155	7.9	15 / 0.749	7.5 / 0.619	5.6 / 0.244	0.8 / 0.020	0 / 0.000	84 / 1.377		3.8 / 0.107			0.28				15	68	0	2		USGS
Apr 4 1415	85	54	10.2	95	176	7.8	21 / 1.048	5.5 / 0.452	6.8 / 0.296	1.0 / 0.026	0 / 0.000	94 / 1.541		4.0 / 0.113			0.49				16	75	0	6		USGS
May 2 1530	324	58	10.5	102	148	6.9	18 / 0.898	4.9 / 0.402	5.3 / 0.230	0.8 / 0.020	0 / 0.000	79 / 1.295	8.4 / 0.175	4.2 / 0.118	0.2 / 0.003	0.1 / 0.005	0.23	9.3	Fe 0.1; Al 0.02; (a) PO_4 0.00	90[b]	15	65	0	2		USGS
Jun 23 1500	226	65	9.8	103	156	7.4	21 / 1.048	4.0 / 0.332	5.4 / 0.235	0.5 / 0.013	0 / 0.000	86 / 1.409		3.2 / 0.090			0.26		Al 0.03; (a)		14	69	0	0.3		USGS
Jul 11 1515	212	70	8.6	95	158	7.1	19 / 0.948	5.3 / 0.432	5.4 / 0.235	0.6 / 0.015	0 / 0.000	86 / 1.409		3.2 / 0.090			0.33				14	69	0	2		USGS
Aug 1 1300	Not Sampled																									
Sep 12 1700	231	74	7.8	90	175	7.1	21 / 1.048	5.4 / 0.448	5.7 / 0.248	0.7 / 0.018	0 / 0.000	96 / 1.573	7.0 / 0.146	3.4 / 0.096	0.3 / 0.005	0.1 / 0.005	0.35	7.7	Fe 0.02; Al 0.03; Cu 0.01; (a)	99[b]	14	75	0	2.0		USGS
Oct 3 1800	231	61	9.0	90	177	7.0	21 / 1.048	6.7 / 0.552	6.3 / 0.274	0.6 / 0.015	0 / 0.000	97 / 1.590		2.7 / 0.075			0.37				15	80	0	5		USGS
Nov 14 1550	231	50	7.8	86	190	6.9	23 / 1.148	6.5 / 0.532	6.9 / 0.300	1.0 / 0.026	0 / 0.000	102 / 1.672		5.0 / 0.141			0.59				15	84	0	6		USGS
Dec 5 1730	240	47	10.0	85	207	6.8	26 / 1.297	5.6 / 0.463	8.7 / 0.378	0.9 / 0.023	0 / 0.000	106 / 1.737		6.8 / 0.192			0.75				17	88	1	44		USGS
																									median 2.3	
																									minimum .045 -	
																									maximum 230	

a Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and chromium (Cr), reported here as $\frac{0.0}{0.00}$ except as shown.

b Determined by addition of analysed constituents

c Gravimetric determination

d Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by Calif. Dept of Public Health, Division of Laboratories

e Mineral analyses made by USGS, Quality of Water Branch (USGS), Pacific Chemical Consultant (PCC), Metropolitan Water District (MWD), Los Angeles Dept of Water & Power (LADWP), City of Los Angeles Dept of Pub Health (LADPH), Long Beach Dept of Pub Health (LBDPH) or State Division of Water Resources (DWR), as indicated

ANALYSES OF SURFACE WATER

REGION 1

Date and time sampled	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25° C)	pH	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total Dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity in ppm	Coliform[d] MPN/ml	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																			
							Russian River, East Fork at Potter Valley Power House																			
1956																										
Jan	Not sampled																									
Feb 16 1745	318	44	11.5	94	123	6.9	14 / 0.699	4.5 / 0.373	4.2 / 0.183	0.8 / 0.020	0 / 0.000	67 / 1.098		0.0 / 0.000			0.11				14	54	0	45		USGS
Mar 5 1525	317	46	11.6	97	96.8	7.1	12 / 0.599	3.2 / 0.261	3.3 / 0.144	1.0 / 0.026	0 / 0.000	54 / 0.885		2.0 / 0.056			0.31				14	43	0	95		USGS
Apr 2 1220	320	52	10.4	94	122	8.8	12 / 0.599	5.8 / 0.481	4.0 / 0.174	0.9 / 0.023	0 / 0.000	75 / 1.229		0.0 / 0.000			1.5				14	54	0	40		USGS
May 7 1600	320	58	10.0	97	139	7.8*	17 / 0.848	4.9 / 0.400	4.4 / 0.191	0.8 / 0.020	0 / 0.000	80 / 1.311	6.4 / 0.133	2.1 / 0.059	0.4 / 0.006	0.1 / 0.005	0.15	12	Fe 0.01; Al 0.07; Cu 0.01; Zn 0.02; PO_4 0.09 (a)	87[b]	13	62	0	15		USGS
June 11 1700	150	67	8.7	94		6.9																				
July 2 1610	225	64	8.8	92	133	7.7	17 / 0.848	4.3 / 0.352	3.9 / 0.170	0.7 / 0.018	0 / 0.000	78 / 1.278		1.5 / 0.042			0.19				12	60	0	2		USGS
Aug 6 1600	252	68	9.4	103	142	6.8	17 / 0.848	5.7 / 0.472	5.0 / 0.218	0.8 / 0.020	0 / 0.000	85 / 1.393		1.5 / 0.042			0.19				14	66	0	2		USGS
Sept 11 1505	259	69	8.6	95	160	6.8	20 / 0.998	5.5 / 0.450	5.0 / 0.218	0.9 / 0.073	0 / 0.000	94 / 1.541	3.8 / 0.079	2.2 / 0.062	0.4 / 0.006	0.0 / 0.000	0.32	10	Cu 0.01; Zn 0.01; PO_4 0.05; (a)	94[b]	13	72	0	0.4		USGS
Oct 5 1500	230**	69	9.8	108	168	8.0	21 / 1.048	5.7 / 0.472	5.0 / 0.218	0.6 / 0.015	0 / 0.000	100 / 1.639		3.0 / 0.085			0.27				12	76	0	0.9		USGS
Nov 4 1000	301**	54	10.0	93	198	7.4	23 / 1.148	6.8 / 0.560	7.7 / 0.335	0.8 / 0.020	0 / 0.000	109 / 1.787		5.3 / 0.149			0.64				16	85	0	30		USGS
Dec 3 1515	No Record	49	11.2	98	205	7.9	26 / 1.30	6.9 / 0.57	7.0 / 0.30	0.8 / 0.02	0 / 0.000	118 / 1.93		5.0 / 0.14			0.55				14	93	0	0.9		USGS
																									median 1.8	
																									minimum .06	
** Not Reviewed																									maximum 2400	
*Lab pH																										

a Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and chromium (Cr), reported here as $\frac{0.0}{0.00}$ except as shown.

b Determined by addition of analysed constituents

c Gravimetric determination.

d Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by Calif Dept of Public Health, Division of Laboratories.

e Mineral analyses made by USGS, Quality of Water Branch (USGS), Pacific Chemical Consultant (PCC), Metropolitan Water District (MWD), Los Angeles Dept of Water & Power (LADWP), City of Los Angeles Dept of Pub Health (LADPH), Long Beach Dept of Pub Health (LBDPH) or State Division of Water Resources (DWR), as indicated

ANALYSES OF SURFACE WATER

NORTH COASTAL REGION

Date and time sampled	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH f	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm b	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity in ppm	Coliform d MPN/ml	Analyzed by e
							Mineral constituents in parts per million / equivalents per million																			
1957							RUSSIAN RIVER, EAST FORK, AT POTTER VALLEY POWER HOUSE (STA. 10A)																			
1/7 1450	103	42	12.0	95	229	7.9	29 / 1.45	7.2 / 0.59	7.7 / 0.33	0.6 / 0.02	0 / 0.00	129 / 2.11		5.8 / 0.16			0.72				14	102	0	0.5		USGS
2/4 1450	135	43	13.8	111	182	7.7	22 / 1.10	6.4 / 0.53	7.5 / 0.33	0.8 / 0.02	0 / 0.00	98 / 1.61		5.2 / 0.15			0.56				17	82	2	30		USGS
3/4 1500	306	53	12.6	115	145	7.7	14 / 0.70	7.3 / 0.60	5.3 / 0.23	1.4 / 0.04	0 / 0.00	79 / 1.29		1.1 / 0.03			0.24				15	65	0	55		USGS
4/1 1705	161	56	10.8	102	145	7.1	18 / 0.90	4.7 / 0.39	5.3 / 0.23	1.0 / 0.03	0 / 0.00	78 / 1.28		2.0 / 0.06			0.21				15	64	0	29		USGS
5/6 1620	326	60	9.8	98	134	6.9	17 / 0.85	4.1 / 0.34	4.5 / 0.20	0.6 / 0.02	0 / 0.00	74 / 1.21	5.8 / 0.12	2.3 / 0.06	0.3 / 0.00	0.1 / 0.01	0.23	10	PO_4 0.00, Fe 0.01, Al 0.03, Zn 0.03 a	81	14	60	0	5		USGS
6/3 1745	324	68	9.6	104	140	7.3	18 / 0.90	5.8 / 0.48	4.4 / 0.19	0.5 / 0.01	0 / 0.00	77 / 1.26		2.2 / 0.06			0.20				12	69	6	2		USGS
7/8 1340	216	68	8.8	96	139	8.5			4.7 / 0.20		0 / 0.00	78 / 1.28		2.1 / 0.06			0.19				13	66	2	2		USGS
8/5 1510	217	62	10.0	102	140	8.1			4.5 / 0.20		0 / 0.00	78 / 1.28		2.8 / 0.08			0.16				13	65	1	2		USGS
9/10 1400	218	72	8.2	93	155	7.5	20 / 1.00	4.7 / 0.39	4.4 / 0.19	1.2 / 0.03	0 / 0.00	87 / 1.43	7.1 / 0.15	3.0 / 0.08	0 / 0.00	0.1 / 0.01	0.30	14	PO_4 0.05, Fe 0.01, Al 0.03 a	98	12	70	0	2		USGS
10/15 0940	303	58	10.2	100	172	7.9			6.7 / 0.29		0 / 0.00	92 / 1.51		3.5 / 0.10			0.42				17	73	0	19		USGS
11/4 1445	302	54	9.3	86	156	7.3			5.6 / 0.24		0 / 0.00	90 / 1.48		4.2 / 0.12			0.23				14	74	0	3		USGS
12/16 1545	302	50	10.8	95	126	7.6			5.0 / 0.22		0 / 0.00	62 / 1.02		2.2 / 0.06			0.42					56		100	Median 6.2 Max. 7,000 Min. 0.12	USGS

a Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and chromium (Cr), reported here as $\frac{0.0}{0.00}$ except as shown.

b Determined by addition of analyzed constituents.

c Gravimetric determination.

d Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by Calif. Dept. of Public Health, Division of Laboratories.

e Mineral analyses made by USGS, Quality of Water Branch (USGS), Pacific Chemical Consultant (PCC), Metropolitan Water District (MWD), Los Angeles Dept. of Water & Power (LADWP), City of Los Angeles Dept. of Pub Health (LADPH), Long Beach Dept. of Pub Health (LBDPH) or State Department of Water Resources (DWR), as indicated

f Field pH except when noted with *

ANALYSES OF SURFACE WATER

NORTH COASTAL REGION (1)

Date and time sampled PST	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH [f]	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity in ppm	Coliform [d] MPN/ml	Analyzed by [e]
							Mineral constituents in parts per million / equivalents per million																			
1958																										USGS
RUSSIAN RIVER, EAST FORK AT POTTER VALLEY POWERHOUSE																										
1/15 1130	292	45	12.2	101	123	7.6	---	---	4.8/0.21	---	0/0.00	67/1.10	---	2.0/0.06	---	---	0.04/---	---		---	16	54	0	20	Maximum 62. Minimum 0.6 Median 13.	
2/3 1300	296	47	11.8	100	109	7.4	---	---	3.9/0.17	---	0/0.00	58/0.95	---	2.0/0.06	---	---	0.10/---	---		---	14	53	5	55		
3/10 1330	298	49	12.4	108	111	7.7	---	---	3.4/0.15	---	0/0.00	62/1.02	---	2.2/0.06	---	---	0.02/---	---		---	14	48	0	30		
4/4 0920	293	47	12.0	102	105	8.1	---	---	3.2/0.14	---	0/0.00	58/0.95	---	2.5/0.07	---	---	0.05/---	---		---	13	46	0	105		
5/9 0900	254	56	9.2	87	130	7.8	14/0.70	5.1/0.42	4.7/0.20	1.1/0.03	0/0.00	72/1.18	3.8/0.08	3.4/0.10	0.2/0.00	0.0/0.00	0.17/---	13/--	Fe 0.08 Al 0.13 Zn 0.01 PO_4 0.50 a	80[b]	15	56	0	30		
6/6 0915	231	58	9.4	91	131	8.3	---	---	4.1/0.18	---	0/0.00	71/1.16	---	1.5/0.04	---	---	0.1/---	---		---	13	58	0	10		
7/11 0910	171	65	9.2	97	130	7.5	---	---	3.6/0.16	---	0/0.00	73/1.20	---	3.4/0.10	---	---	0.1/---	---		---	12	58	0	2		
8/8 0910	193	67	8.6	94	133	8.5	---	---	3.8/0.17	---	0/0.00	73/1.20	---	2.5/0.07	---	---	0.0/---	---		---	13	58	0	3		
9/12 0915	301	60	8.4	84	144	8.6	18/0.90	5.6/0.46	3.9/0.17	0.9/0.02	0/0.00	83/1.36	3.8/0.08	2.8/0.08	0.5/0.01	0.1/0.01	0.1/---	14/--	Cu 0.02 PO_4 0.05 a	91[b]	11	68	0	1		
10/7 1700	302	70	9.6	107	171	7.6	---	---	5.1/0.22	---	0/0.00	95/1.56	---	4.6/0.13	---	---	0.2/---	---		---	12	77	0	1		
11/10 1430	305	58	9.4	91	182	8.0	---	---	5.0/0.22	---	0/0.00	102/1.67	---	4.5/0.13	---	---	0.3/---	---		---	12	84	0	8		
12/4 1000	88	50	10.3	90	207	7.5	---	---	6.2/0.27	---	0/0.00	118/1.93	---	5.5/0.15	---	---	0.4/---	---		---	12	96	0	10		

a Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and hexavalent chromium (Cr^{+6}), reported are as 0.0/0.00 except as shown.
b Determined by addition of analyzed constituents.
c Gravimetric determination.
d Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by Calif. Dept. of Public Health, Division of Laboratories, or United States Public Health Service.
e Mineral analyses made by USGS, Quality of Water Branch (USGS), United States Public Health Service (USPHS), San Bernardino County Flood Control District (SBCFCD), Metropolitan Water District (MWD), Los An Dept. of Water & Power (LADWP), City of Los Angeles Dept. of Pub. Health (LADPH), Long Beach D Pub. Health (LBDPH), Terminal Testing Laboratories, Inc. (TTL), State Departme Water Resources (DWR), as indicated.
f Field pH except when noted with *

ANALYSES OF SURFACE WATER

NORTH COASTAL REGION (NO. 1)

RUSSIAN RIVER, EAST FORK AT POTTER VALLEY POWERHOUSE

Date and time sampled P.S.T.	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity in ppm	Coliform[h] MPN/ml	Analyzed by[i]
							Mineral constituents in parts per million / equivalents per million																			
1959																									Median 6.2	USGS
1/6 1120	312	42	11.3	89	148	7.5[b]	1.24[c]		5.6 / 0.24		0.0 / 0.00	72 / 1.18		5.0 / 0.14			0.3			89[e]	16	62	3	25	Maximum 620	
2/6 1100	307	44	11.1	91	138	7.4[a]	1.26[c]		5.0 / 0.22		0.0 / 0.00	67 / 1.10		3.0 / 0.08			0.3			83[e]	15	63	8	27	Minimum 0.045	
3/2 1115	163	47	11.1	94	114	7.3[a]	1.08[c]		3.3 / 0.14		0.0 / 0.00	56 / 0.92		3.0 / 0.08			0.1			68[e]	11	54	8	70		
4/2 1100	212	54	9.9	92	135	7.3[a]	1.16[c]		4.3 / 0.19		0.0 / 0.00	70 / 1.15		3.0 / 0.08			0.3			81[e]	14	58	1	40		
5/13 1245	75	62	8.6	88	155	7.8[b]	19 / 0.95	4.7 / 0.39	5.4 / 0.23	0.3 / 0.01	0.0 / 0.00	83 / 1.36	6.3 / 0.13	2.8 / 0.08	0.0 / 0.00	0.1 / 0.01	0.3	11	Fe 0.01 Al 0.04[d] PO_4 0.05	91[f]	15	67	0	2		
6/11 1100	302	50	9.3	82	126	7.4[a]	1.24[c]		4.2 / 0.18		0.0 / 0.00	71 / 1.16		3.5 / 0.10			0.2			76[e]	13	62	4	20		
7/1 1220	307	59	8.9	88	137	7.4[a]	1.20[c]		4.4 / 0.19		0.0 / 0.00	76 / 1.25		2.5 / 0.07			0.2			82[e]	14	60	0	0.8		
8/13 0840	320	67	7.7	83	148	7.5[a]	1.32[c]		4.7 / 0.20		0.0 / 0.00	82 / 1.34		2.5 / 0.07			0.3			89[e]	13	66	0	3		
9/3 1325	260	70	8.0	89	160	7.7[a]	19 / 0.95	6.0 / 0.49	5.3 / 0.23	1.1 / 0.03	0.0 / 0.00	87 / 1.43	5.8 / 0.12	3.1 / 0.09	0.0 / 0.00	0.0 / 0.00	0.3	7.2	Al 0.01 Cu 0.02[d] PO_4 0.00	91[f]	14	72	1	2		
10/4	Dry																									
11/4	Dry																									
12/3 1305	16	46	10.5	90	208	7.3[a]	1.88[c]		7.4 / 0.32		0.0 / 0.00	116 / 1.90		5.2 / 0.15			0.7			125[e]	15	94	0	3		

a Field pH.

b Laboratory pH.

c Sum of calcium and magnesium in epm.

d Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and hexavalent chromium (Cr^{+6}), reported here as $\frac{0.0}{0.00}$ except as shown.

e Derived from conductivity vs TDS curves.

f Determined by addition of analyzed constituents.

g Gravimetric determination.

h Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by California Department of Public Health, Division of Laboratories, or United States Public Health Service.

i Mineral analyses made by United States Geological Survey, Quality of Water Branch (USGS); United States Department of the Interior, Bureau of Reclamation (USBR); United States Public Health Service (USPHS);; San Bernardino County Flood Control District (SBCFCD); Metropolitan Water District of Southern California (MWD); Los Angeles Department of Water and Power (LADWP); City of Los Angeles, Department of Public Health (LADPH); City of Long Beach, Department of Public Health (LBDPH); Terminal Testing Laboratories, Inc. (TTL); or California Department of Water Resources (DWR); as indicated.

ANALYSES OF SURFACE WATER

NORTH COASTAL REGION (NO. 1)

RUSSIAN RIVER, EAST FORK AT POTTER VALLEY POWERHOUSE

Date and time sampled P.S.T	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH[a]	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity in ppm	Coliform[h] MPN/ml	Analyzed by[i]
1960																										USGS
1/14 0900	43	38	12.2	94	232	7.3	1.94[c]		12 / 0.52		0.0 / 0.00	115 / 1.88		9.0 / 0.25			1.4			139[e]	21	97	3	20	Median 2.3	
2/3 1700	299	45	10.7	91	129	7.2	1.28[c]		4.5 / 0.20		0.0 / 0.00	65 / 1.07		8.0 / 0.23			0.3			77[e]	14	64	11	70	Maximum 62.	
3/10 1315	298	47	10.9	95	101	7.3	0.88[c]		2.7 / 0.12		0.0 / 0.00	46 / 0.75		3.2 / 0.09			0.2			61[e]	12	44	6	500	Minimum 0.23	
4/14 1310	300	53	10.0	95	125	7.3	1.08[c]		3.4 / 0.15		0.0 / 0.00	64 / 1.05		3.0 / 0.08			0.3			75[e]	12	54	2	60		
5/11 1040	195	58	9.2	93	139	7.3	17 / 0.85	5.0 / 0.41	6.0 / 0.26	0.9 / 0.02	0.0 / 0.00	78 / 1.28	8.0 / 0.17	3.5 / 0.10	0.2 / 0.00	0.0 / 0.00	0.3	13	Fe 0.08 Al 0.13 PO_4 0.05[d] Cu 0.01	92[f]	17	63	0	20		
6/14 1605	134	68	8.1	91	146	7.5	1.32[c]		4.2 / 0.18		0.0 / 0.00	80 / 1.31		4.8 / 0.14			0.3			88[e]	12	66	0	10		
7/13 1445	298	62	9.2	97	136	7.5	1.30[c]		3.6 / 0.16		0.0 / 0.00	78 / 1.28		4.5 / 0.13			0.1			82[e]	11	65	1	8		
8/4 1130	79	67	8.2	91	141	7.5	1.24[c]		4.7 / 0.20		0.0 / 0.00	77 / 1.26		3.2 / 0.09			0.3			85[e]	14	62	0	3		
9/14 1205	103	64	8.8	95	149	7.5	17 / 0.85	6.0 / 0.49	5.7 / 0.25	0.6 / 0.02	0.0 / 0.00	86 / 1.41	6.0 / 0.12	3.0 / 0.08	0.0 / 0.00	0.1 / 0.01	0.3	14	Fe 0.01 Al 0.07 Cu 0.01[d] PO_4 0.05	95[f]	16	67	0	8		
10/12 1420	245	62	9.1	96	164	7.5	19 / 0.95	6.0 / 0.49	5.4 / 0.23		0.0 / 0.00	90 / 1.48		3.5 / 0.10			0.2			98[e]	14	72	0	1		
11/3 1235	307	56	9.5	93	174	7.5	1.56[c]		5.6 / 0.24		0.0 / 0.00	95 / 1.56		5.5 / 0.16			0.4			104[e]	13	78	0	4		
12/7 1300	303	44	11.2	94	144	7.3	1.22[c]		5.3 / 0.23		0.0 / 0.00	72 / 1.18		3.8 / 0.11			0.4			86[e]	16	61	2	49		

Mineral constituents in parts per million / equivalents per million.

a Field pH.

b Laboratory pH.

c Sum of calcium and magnesium in epm.

d Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and hexavalent chromium (Cr^{+6}), reported here as $\frac{0.0}{0.00}$ except as shown.

e Derived from conductivity vs TDS curves.

f Determined by addition of analyzed constituents.

g Gravimetric determination.

h Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by California Department of Public Health, Division of Laboratories, or United States Public Health Service.

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ANALYSES OF SURFACE WATER

NORTH COASTAL REGION (1)

RUSSIAN RIVER, EAST FORK AT POTTER VALLEY P. H.

Date and time sampled P.S.T.	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen % Sat	Specific conductance (micromhos at 25°C)	pH[a]	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO3)	Bicarbonate (HCO3)	Sulfate (SO4)	Chloride (Cl)	Nitrate (NO3)	Fluoride (F)	Boron (B)	Silica (SiO2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as CaCO3 Total ppm	Hardness as CaCO3 N.C. ppm	Turbidity in ppm	Coliform[h] MPN/ml	Analyzed by[i]
							Mineral constituents in parts per million / equivalents per million																			
1961																										USGS
1/4 1310	193	41	11.5	92	146	7.2	1.42[c]		5.8 / 0.25		0.0 / 0.00	88 / 1.44		3.2 / 0.09			0.4			88[e]	15	71	0	40	Median 2.1	
2/17 0730	300	48	11.4	101	108	7.3	0.98[c]		4.0 / 0.17		0.0 / 0.00	54 / 0.89		0.8 / 0.02			0.1			65[e]	15	49	5	35	Maximum 23.	
3/13 1440	300	50	11.0	100	130	7.3	1.14[c]		4.2 / 0.18		0.0 / 0.00	66 / 1.08		1.5 / 0.04			0.3			78[e]	14	57	3	30	Minimum 0.13	
4/12 1320	305	51	10.2	94	137	7.4	1.24[c]		4.1 / 0.18		0.0 / 0.00	75 / 1.23		2.0 / 0.06			0.2			82[e]	13	62	0	8		
5/3 1210	309	53	10.3	98	134	7.3	16 / 0.80	4.9 / 0.40	4.8 / 0.21	0.9 / 0.02	0.0 / 0.00	75 / 1.23	5.8 / 0.12	2.0 / 0.06	0.0 / 0.00	0.2 / 0.01	0.2	10	Fe 0.04 Al 0.08[d] Zn 0.01 ABS 0.1	82[f]	15	60	0	5		
6/2 0705	211	60	8.7	90	148	7.6	1.32[c]		4.9 / 0.21		0.0 / 0.00	78 / 1.28		2.5 / 0.07			0.2			89[e]	14	66	2	3		
7/8 0745	106	66	8.4	94	152	7.6	1.38[c]		4.7 / 0.20		0.0 / 0.00	90 / 1.48		0.7 / 0.02			0.1			91[e]	13	69	0	6		
8/2 0925	90	68	8.[illegible]	99	150	7.9	1.44[c]		4.6 / 0.20		0.0 / 0.00	80 / 1.31		2.8 / 0.08			0.3			90[e]	12	72	6	2		
9/6 1020	269	60	8.8	91	150	7.[illegible]	19 / 0.95	5.0 / 0.41	4.5 / 0.20	0.7 / 0.02	0.0 / 0.00	81 / 1.33	7.0 / 0.15	2.0 / 0.06	0.5 / 0.01	0.0 / 0.00	0.2	10	Fe 0.06 Mn 0.26[d] Zn 0.04	89[f]	13	68	2	2		
10/3 0915	263	65	8.2	90	165	7.7	1.46[c]		4.5 / 0.20		0.0 / 0.00	90 / 1.48		3.0 / 0.08			0.3			99[e]	12	73	0	5		
11/10 1100	305	52	9.9	93	177	7.6	1.60[c]		4.9 / 0.21		0.0 / 0.00	99 / 1.62		3.2 / 0.09			0.2			106[e]	12	80	0	6		
12/12 1610	307	45	10.5	89	151	7.2	1.30[c]		5.3 / 0.23		0.0 / 0.00	76 / 1.25		5.2 / 0.15			0.5			91[e]	15	65	3	30		

a Field pH

b Laboratory pH.

c Sum of calcium and magnesium in epm.

d Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and hexavalent chromium (Cr^{+6}), reported here as $\frac{0.0}{0.00}$ except as shown.

e Derived from conductivity vs TDS curves

f Determined by addition of analyzed constituents.

g Gravimetric determination

h Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by California Department of Public Health, Division of Laboratories, or United States Public Health Service.

i Mineral analyses made by United States Geological Survey, Quality of Water Branch (USGS); United States Department of the Interior, Bureau of Reclamation (USBR); United States Public Health Service (USPHS); San Bernardino County Flood Control District (SBCFCD), Metropolitan Water District of Southern California (MWD); Los Angeles Department of Water and Power (LADWP); City of Los Angeles, Department of Public Health (LADPH); City of Long Beach, Department of Public Health (LBDPH), Terminal Testing Laboratories, Inc. (TTL); or California Department of Water Resources (DWR); as indicated.

ANALYSES OF SURFACE WATER

NORTH COASTAL REGION (1)

RUSSIAN RIVER, EAST FORK AT POTTER VALLEY POWERHOUSE

Date and time sampled PST	Discharge in cfs	Temp in °F	Dissolved oxygen (e = 0.97) ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH [a]	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity in ppm	Coliform[h] MPN/ml	Analyzed by[i]
							Mineral constituents in parts per million / equivalents per million																			
1962																										
1/9 1525	312	46	11.2	97	154	7.3	1.35[c]		5.2 / 0.23		0 / 0.00	77 / 1.26		4.5 / 0.13			0.4			92[e]	15	68	5	15	Median 23	USGS
2/15 1130	298	46	11.4	98	118	7.1	1.13[c]		3.5 / 0.15		0 / 0.00	62 / 1.02		2.5 / 0.07			0.1			71[e]	12	57	6	70	Max. 620.	
3/7 1610	302	44	10.5	88	107	7.5	0.96[c]		3.2 / 0.14		0 / 0.00	56 / 0.92		2.2 / 0.06			0.1			64[e]	13	48	2	95	Min. 0.23	
4/11 1625	310	58	9.1	92	122	7.9	1.08[c]		4.3 / 0.19		0 / 0.00	65 / 1.07		1.6 / 0.05			0.0			73[e]	15	54	1	20		
5/10 1025	107	56	11.1	109	151	8.1	17 / 0.85	5.5 / 0.45	5.9 / 0.26	0.9 / 0.02	0 / 0.00	79 / 1.29	8.0 / 0.17	2.2 / 0.06	0.1 / 0.00	0.1 / 0.01	0.4	13	PO_4 0.05	92[f]	16	65	0	6		
6/7 0812	147	61	10.0	104	143	7.7	1.34[c]		6.4 / 0.28		0 / 0.00	76 / 1.25		2.0 / 0.06			0.1			86[e]	17	67	5	4		
7/10 1520	201	64	9.8	106	137	8.0	1.21[c]		4.8 / 0.21		0 / 0.00	74 / 1.21		2.0 / 0.06			0.2			82[e]	15	61	0	5		
8/9 0744	222	56	8.5	83	139	7.8	1.20[c]		4.6 / 0.20		0 / 0.00	78 / 1.28		2.0 / 0.06			0.2			83[e]	14	60	0	5		
9/13 0914	222	75	8.3	101	149	7.0	18 / 0.90	5.4 / 0.44	4.9 / 0.21	0.4 / 0.01	0 / 0.00	83 / 1.36	8.0 / 0.17	2.5 / 0.07	0.2 / 0.00	0.0 / 0.00	0.0	15	PO_4 0.15	105[g]	13	67	0	2		

a Field pH

b Laboratory pH

c Sum of calcium and magnesium in epm

d Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and hexavalent chromium (Cr^{+6}), reported here as $\frac{0.0}{0.00}$ except as shown.

e Derived from conductivity vs TDS curves f = 0.600

f Determined by addition of analyzed constituents

g Gravimetric determination

h Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by California Department of Public Health, Division of Laboratories, or United States Public Health Service

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ANALYSES OF SURFACE WATER

NORTH COASTAL REGION (NO 1)

Date and time sampled P.S.T.	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen % Sat	Specific conductance (micromhos at 25°C)	pH a / b	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Per cent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity in ppm	Coliform MPN/ml	Analyzed by i
								Mineral constituents in parts per million / equivalents per million																		
								RUSSIAN RIVER, EAST FORK AT POTTER VALLEY POWERHOUSE																		
[illegible]-10-62 1155	338	63	8 4	9[illegible]	161	7 5 / 7 7		1 40[c]	6 2 / 0 27		0 / 0 00	87 / 1 43		5.4 / 0.15			0.3			9[illegible][e]	16	7[illegible]	0	2[illegible]	62 23	USGS
11-15-62 1145	309	54	10 1	97	150	7 6 / 7 6		1 28[c]	6.0 / 0 26		0 / 0 00	82 / 1.34		3.5 / 0 10			[illegible]			90[e]	17	64	0	45	6 2 23	
12-12-62 0905	302	46	10 4	90	145	7.2 / 7 8		1.27[c]	5 5 / 0.24		0 / 0.00	80 / 1 31		2.8 / 0.08			0.4			87[e]	16	64	0	35	13 62	
1-4-63 1035	307	44	10 9	92	149	7 3 / 7 9		1 32[c]	6 0 / 0 26		0 / 0 00	82 / 1.34		5.6 / 0.16			0.3			90[e]	16	66	0	20	0 23 0 5	
2-13-63 0905	299	50	11 2	102	108	7.3 / 7 5		0 96[c]	3.3 / 0.14		0 / 0.00	60 / 0 98		1.2 / 0.03			0.1			65[e]	13	48	[illegible]	90	62 13.	
3-13-63 1005	185	49	10 7	96	139	7.3 / 7.7		1 24[c]	3.9 / 0 17		0 / 0.00	76 / 1 25		2 8 / 0 08			0.2			84[e]	12	62	0	50	6 2 2 3	
4-11-63 1130	384	48	10 9	97	114	8.1 / 7 9		1.03[c]	3.3 / 0.14		0 / 0.00	64 / 1 05		2 0 / 0.06			0.0			69[e]	12	51	0	95	23 2 3	
5-7-63 1550	300	59	10.0	102	129	7.4 / 7.9	15 / 0.75	5.5 / 0.45	4.0 / 0 17	0.5 / 0.01	0 / 0.00	73 / 1 20	5.2 / 0.11	1.7 / 0.05	0.5 / 0.01	0 2 / 0.01	0.2	12	As = 0.00 ABS = 0 0 PO_4 = 0.10	86[g]	12	60	0	45	23. 0 62	
6-11-63 0900	267	59	9 8	100	140	7. / 7.9		1 23[c]	4.3 / 0.19		0 / 0.00	80 / 1.31		1.6 / 0.05			0.3			84[e]	13	62	0	35	2.3 2 3	
7-9-63 1015	263	60	9.7	100	136	7.6 / 7.8		1.32[c]	4.1 / 0.18		0 / 0.00	79 / 1.29		2.4 / 0.07			0.3			82[e]	12	66	1	10	2 3 23	
8-6-63 0830	284	65	9.8	107	140	7. / 7.8		1.27[c]	4.2 / 0.18		0 / 0.00	76 / 1.25		2.6 / 0.07			0.0			84[e]	12	63	1	4	2 3 0 5	
9-11-63 1245	278	69	8.9	101	154	7.5 / 8.3	20 / 1.00	4.6 / 0.38	48 / 0.21	0.8 / 0.02	3 / 0.10	82 / 1 34	6.0 / 0.12	2.0 / 0.06	0.6 / 0.01	0.0 / 0.00	0.3	13	As = 0.00 ABS = 0.0 PO_4 = 0.00	96[g]	13	69	0	5	6.2 50	

a Field pH

b Laboratory pH

c Sum of calcium and magnesium in epm.

d Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and hexavalent chromium (Cr^{+6}), reported here as $\frac{0.0}{0.00}$ except as shown.

e Derived from conductivity vs TDS curves

f Determined by addition of analyzed constituents.

g Gravimetric determination.

h Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by California Department of Public Health, Division of Laboratories, or United States Public Health Service

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ANALYSES OF SURFACE WATER

NORTH COASTAL REGION (NO. 1)

Date and time sampled P.S.T.	Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH a / b	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents	Total dissolved solids in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N.C. ppm	Turbidity in ppm	Coliform[h] MPN/ml	Analyzed by[i]
							Mineral constituents in parts per million / equivalents per million																			
RUSSIAN RIVER, EAST FORK, AT POTTER VALLEY POWER HOUSE																										
10-10-63 1445	217	62	8.4	89	178	7.7 / 7.9		1.62[c]	5.0 / 0.22		0 / 0.00	99 / 1.62		4.8 / 0.14			0.1				12	81	0	6	23. / 23.	USGS
11-13-63 1100	309	55	9.9	96	193	7.4 / 8.2		1.70[c]	7.0 / 0.30		0 / 0.00	106 / 1.74		5.8 / 0.16			0.7				15	85	0	10	6.2 / 23.	
12-13-63 0920	302	43	11.4	94	167	7.3 / 7.8		1.50[c]	5.5 / 0.24		0 / 0.00	89 / 1.46		4.8 / 0.14			0.4				14	75	2	10	.62 / 2.3	
1-8-64 0950	303	43	11.3	93	164	7.3 / 8.5		1.47[c]	5.9 / 0.26		6 / 0.20	84 / 1.38		4.5 / 0.13			0.3				15	74	0	3	2.3 / .62	
2-5-64 0930	299	43	11.9	98	136	7.3 / 7.9		1.22[c]	5.3 / 0.23		0 / 0.00	72 / 1.18		2.8 / 0.08			0.2				16	61	2	40	2.1 / 2.3	
3-11-64 1230	298	44	11.6	97	146	7.4 / 7.9		1.29[c]	5.3 / 0.23		0 / 0.00	77 / 1.26		3.8 / 0.11			0.3				15	65	2	15	.62 / .62	
4-15-64 0945	60	59	9.4	96	179	7.6 / 8.6		1.58[c]	7.0 / 0.30		4 / 0.13	92 / 1.51		5.2 / 0.15			0.4				16	79	0	2	21. / 2.3	
5-12-64 0800	27	64	9.0	97	186	7.6 / 8.0	22 / 1.10	6.6 / 0.54	6.5 / 0.28	0.5 / 0.01	0 / 0.00	98 / 1.61	10 / 0.21	5.8 / 0.16	0.5 / 0.01	0.1 / 0.01	0.6	9.7	As = 0.00 ABS = 0.0 PO_4 = 0.00	108	15	82	2	1	50. / 2.3	
6-3-64 0845	28	64	9.1	98	182	7.9 / 7.9		1.60[c]	7.0 / 0.30		0 / 0.00	97 / 1.59		3.5 / 0.10			0.5				16	80	0	2	6.2 / .62	
7-16-64 0930	200	68	9.1	103	168	7.6 / 7.9		1.50[c]	5.6 / 0.24		0 / 0.00	90 / 1.48		2.6 / 0.07			0.3				14	75	1	3	13. / 2.3	
8-11-64 0930	120	66	8.9	98	169	8.0 / 8.2		1.50[c]	6.6 / 0.29		0 / 0.00	91 / 1.49		2.5 / 0.07			0.4				16	75	0	2	2.3 / 2.3	
9-2-64 0910	130	59	8.7	89	172	7.4 / 8.0	25 / 1.25	3.8 / 0.31	6.0 / 0.26	0.4 / 0.01	0 / 0.00	93 / 1.52	7.0 / 0.15	2.9 / 0.08	0.5 / 0.01		0.4	9.9	As = 0.01 ABS = 0.0 PO_4 = 0.00	103	14	78	2	2	2.3 / 6.2	

a Field pH

b Laboratory pH

c Sum of calcium and magnesium in epm.

d Iron (Fe), aluminum (Al), arsenic (As), copper (Cu), lead (Pb), manganese (Mn), zinc (Zn), and hexavalent chromium (Cr^{+6}), reported here as $\frac{0.0}{0.00}$ except as shown.

e Derived from conductivity vs TDS curves

f Determined by addition of analyzed constituents

g Gravimetric determination

h Annual median and range, respectively. Calculated from analyses of duplicate monthly samples made by California Department of Public Health, Division of Laboratories, or United States Public Health Service

i Mineral analyses made by United States Geological Survey, Quality of Water Branch (USGS); United States Department of the Interior, Bureau of Reclamation (USBR); United States Public Health Service (USPHS); San Bernardino County Flood Control District (SBCFCD); Metropolitan Water District of Southern California (MWD), Los Angeles Department of Water and Power (LADWP); City of Los Angeles, Department of Public Health (LADPH); City of Long Beach, Department of Public Health (LBDPH); Terminal Testing Laboratories, Inc. (TTL); or California Department of Water Resources (DWR); as indicated.

ANALYSES OF SURFACE WATER

Date and time sampled PST	Discharge in cfs	Temp in °F	Dissolved oxygen		Specific conductance (micromhos at 25°C)	pH	Mineral constituents in parts per million / equivalents per million														Total dissolved solids in ppm	Per-cent sod-ium	Hardness as $CaCO_3$		Tur-bid-ity	Coliform MPN/ml	Analyzed by[d]
			ppm	%Sat		a / b	Calcium (Ca)	Magne-sium (Mg)	Sodium (Na)	Potas-sium (K)	Carbon-ate (CO_3)	Bicar-bonate (HCO_3)	Sul-fate (SO_4)	Chlo-ride (Cl)	Ni-trate (NO_3)	Fluo-ride (F)	Boron (B)	Silica (SiO_2)	Other constituents			Total ppm	N C ppm	a / b		
NORTH COASTAL REGION (NO. 1)																										
RUSSIAN RIVER, EAST FORK, AT POTTER VALLEY POWER HOUSE																										
[illegible]	[illegible]	[illegible]	9.3	102	190	8.0 / 8.0		— / 1.78[e]	6.8 / 0.30		0 / 0.00	103 / 1.69		3.7 / 0.10			0.5				14	89	[illegible]	— / 1	23. / 230	[illegible]
11-10-6[illegible] [illegible]	292	52	7.6	71	194	7.6 / 8.2		— / 1.64[e]	7.7 / 0.33		0 / 0.00	98 / 1.61		5.2 / 0.15			0.7				1[illegible]	82	2	— / 70	62 / 230	
12-2-64 110[illegible]	279	52	11.4	107	153	7.4 / 8.1		— / 1.28[e]	6.4 / 0.28		0 / 0.00	76 / 1.25		3.3 / 0.09			0.5				18	64	2	— / 50	23. / 230	
1-[illegible]-65 084[illegible]	310	44	11.8	99	87	6.8 / 7.5		— / 0.79[e]	3.4 / 0.15		0 / 0.00	46 / 0.75		1.0 / 0.03			0.1				16	40	2	— / 700	23 / 23.	
2-3-65 0825	325	41	11.8	95	118	7.6 / 7.6		— / 1.04[e]	3.6 / 0.16		0 / 0.00	63 / 1.03		1.2 / 0.03			0.1				13	52	0	— / 230	23. / 23.	
3-12-65 0820		50	9.9	90	157	7.4 / 7.7		— / 1.46[e]	5.1 / 0.22		0 / 0.00	85 / 1.39		2.2 / 0.06			0.2				13	73	3	— / 400	2.3 / 23.	
4-14-65 0850	310 est.	51	12.2	112	151	7.0 / 7.5		— / 1.36[e]	5.1 / 0.22		0 / 0.00	79 / 1.29		2.2 / 0.06			0.4				14	68	3	— / 70	62. / 230.	
5-12-65 0750	310	55	10.1	98	143	7.6 / 8.2	19 / 0.95	4.0 / 0.33	4.4 / 0.19	0.8 / 0.02	0 / 0.00	76 / 1.25	7.0 / 0.15	1.8 / 0.05	1.1 / 0.02		0.1	12	As 0.00; ABS 0.0; PO[illegible] [illegible]	96	13	64	2	— / 60	23. / 62.	
6-2-65 0930	224	64	10.5	113	153	7.8 / 8.2		— / 1.36[e]	5.1 / 0.22		0 / 0.00	81 / 1.33		1.4 / 0.04			0.3				14	68	2	— / 40	2.3 / 23.	

a Field determination.

b Laboratory analysis.

c Analyzed by California Department of Public Health, Division of Laboratories.

d Mineral analyses made by United States Geological Survey, Water Resources Division (USGS) or California Department of Water Resources (DWR) as indicated.

e Sum of calcium and magnesium in epm.

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

RUSSIAN RIVER ABOVE EAST FORK RUSSIAN RIVER (STATION 38)
16N/12W-33F

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents[b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hach / Hellige	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																		
7-8-65 1210	2.7	85	10.5	136	264	8.4 / 8.4	26 / 1.30	12 / 1.02	11 / 0.48	1.4 / 0.04	4 / 0.13	136 / 2.23	10 / 0.21	7.3 / 0.20	0.4 / 0.01	0.2 / 0.01	0.0		PO_4 = 0.03 Fe = 1.4 Color = 0	154	17	116	0	< 5	DWR
9-27-65 1435	0.5	66	9.7	104	310	8.4 / 8.3	2.64[c]				0 / 0.00	138 / 2.26		13 / 0.37	0.3 / 0.00				PO_4 = 0.03 Fe = 0.07			132	19	< 5	DWR
10-25-65 1510	1.0	72.5	11.0	126	300	8.7	28.8 / 1.44	12.6 / 1.04			24 / 0.40	128 / 2.10										124	0	< 5	Field Determination
12-14-65 1320	23	50.5	11.9	106	237	8.1 / 8.2	2.02[c]				0 / 0.00	115 / 1.88		8.0 / 0.22	2.5 / 0.04				PO_4 = 0.26 Fe = 0.00			101	7	115	DWR
1-18-66 0900	107	42	12.2	96.6	188	7.2	1.56[c]				0 / 0.00	86 / 1.41		5.6 / 0.16	6.5 / 0.10				PO_4 = 0.07			78	7	19	DWR
2-28-66 1450	219	53	11.2	103	150	7.5 / 8.2	16 / 0.80	7.3 / 0.60			0 / 0.00	76 / 1.24		3.3 / 0.09	1.9 / 0.03		0.0			101		70	8	22	DWR
4-12-66 0928	348	53	10.9	100	152	6.7	1.30[c]					73		4.8 / 0.14	5.4 / 0.09				PO_4 = 0.24 (Ortho)			65		100	DWR
5-11-66 1335	18	73	10.6	122	200	8.5						122		5.3 / 0.15	0.7 / 0.01				PO_4 = 0.02 (Ortho)					< 5 / 2.5	DWR
6-7-66 1310	8.6	71	13.3	150	240	8.9	1.82[c]					153		5.9 / 0.17	0.8 / 0.01				PO_4 = 0.02 (Ortho)			91		< 5 / 0.8	DWR
7-20-66 1030	0.6	73	7.7	88.7	280	8.3						159							Fe = 0.03 Mn = 0.02					< 5 / 0.4	DWR
8-16-66 1440	0.1	78	7.7	93.4	270	7.7						140		13 / 0.37	2.8 / 0.04		0.5		PO_4 = 0.07 (Ortho) Fe = 0.05 Mn = 0.02	165				< 5 / 0.2	DWR

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hach turbidity in Jackson Turbidity Units using Hach Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

YORK CREEK (STATION 39)
16N/12W-33E

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents[b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hach / Hellige	Analyzed by[e]
							Mineral constituents in parts per million / equivalents per million																		
7-8-65 1245	1/2	75.5	8.5	100	230	7.0 / 8.3	20 / 1.00	12 / 0.99	8.7 / 0.38	1.4 / 0.04	0 / 0.00	122 / 2.00	7.7 / 0.16	7.6 / 0.21	1.1 / 0.02	0.2 / 0.01	0.0		PO_4 = 0.01 Fe = 0.45 Color = 0	141	16	101	1	< 5	DWR
9-27-65 1500	1/4	64	7.5	78.4	250	6.9 / 8.5	/ 2.26[c]				4 / 0.13	128 / 2.10		7.0 / 0.20	0.6 / 0.01				PO_4 = 0.02			113	8	< 5	DWR
12-14-65 1250	2	50	11.4	101	238	7.4 / 8.1	/ 2.06[c]				0 / 0.00	114 / 1.87		7.5 / 0.21	2.5 / 0.04				PO_4 = 0.03 Fe = 0.57			103	9	< 5	DWR
1-18-66 0840	8	40	11.8	90.7	189	7.1 / 7.9	/ 1.62[c]				0 / 0.00	90 / 1.48		5.4 / 0.15	3.6 / 0.06				PO_4 = 0.06			81	7	< 5	DWR
2-28-66 1600	15	55.5	10.9	103	144	7.3 / 7.6	14 / 0.70	6.3 / 0.52				73		3.6 / 0.10	1.2 / 0.02		0.0			90		61		20	DWR
4-11-66 1500	6	58	10.4	102	180	7.9	/ 1.54[c]					92		4.6 / 0.13	0.6 / 0.01				PO_4 = 0.03 (Ortho)			77		13	DWR
5-11-66 1315	3/4	71	12.0	135	215	7.3						122		6.3 / 0.18	2.8 / 0.04				PO_4 = 0.01 (Ortho)					< 5 / 1.0	DWR
6-7-66 1210	1/2	68	9.5	104	240	7.1	/ 1.74[c]					134		6.4 / 0.18	2.4 / 0.04				PO_4 = 0.02 (Ortho)					< 5 / 1.0	DWR
7-19-66 1530	1/4	73	8.6	99.1	240	6.9						134							Fe = 0.15 Mn = 0.03					< 5 / 0.9	DWR
8-16-66 1235	1/4	74	8.2	95.4	240	6.7						140		7.7 / 0.22	2.3 / 0.04				PO_4 = 0.05 (Ortho) Fe = 0.36 Mn = 0.10	137				< 5 / 1.7	DWR

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hach turbidity in Jackson Turbidity Units using Hach Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

ANALYSES OF SURFACE WATER

RUSSIAN RIVER WATERSHED

FORSYTHE CREEK (STATION 40)
16N/12W-7H

Date and time sampled P.S.T.	Estimated Discharge in cfs	Temp in °F	Dissolved oxygen ppm	Dissolved oxygen %Sat	Specific conductance (micromhos at 25°C)	pH Field / Lab	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Fluoride (F)	Boron (B)	Silica (SiO_2)	Other constituents [b]	Total dissolved solids[c] in ppm	Percent sodium	Hardness as $CaCO_3$ Total ppm	Hardness as $CaCO_3$ N C ppm	Turbidity[d] in ppm Hach / Hellige	Analyzed by[e]
7-8-65 0830	1	70	8.3	92.6	298	7.3 / 8.2	39 / 1.95	9.6 / 0.79	9.2 / 0.40	1.7 / 0.04	0 / 0.00	164 / 2.69	8.7 / 0.18	5.7 / 0.16	0.4 / 0.01	0.0 / 0.00	0.2		PO_4 = 0.01 Fe = 0.08 Color = 0	154	12	137	3	< 5	DWR
9-27-65 1140	1/2	64	6.2	64.8	300	7.2 / 8.4	2.82[c]				5 / 0.17	163 / 2.67		6.8 / 0.19	0.3 / 0.00				PO_4 = 0.02			141	0	< 5	DWR
10-25-65 1230	1/2	74	8.0	93.0	320	7.1	42.1 / 2.10	9.7 / 0.80			0 / 0.00	165 / 2.70										145	10	< 5	Field Determination
12-14-65 0940	5	45	10.5	86.7	265	7.7 / 8.3	2.32[c]				0 / 0.00	134 / 2.20		5.8 / 0.16	1.0 / 0.02				PO_4 = 0.02			116	6	< 5	DWR
1-17-66 1335	25	52	11.5	104	177	7.6 / 8.1	1.50[c]				0 / 0.00	89 / 1.46		2.7 / 0.08	1.0 / 0.02				PO_4 = 0.12			75	2	55	DWR
2-28-66 1245	35	52	11.5	104	149	8.3 / 8.2	16 / 0.80	5.8 / 0.48			0 / 0.00	78 / 1.28		2.9 / 0.08	0.5 / 0.01		0.0			99		64	0	42	DWR
4-11-66 1300	45	58	10.7	104	178	8.3	1.40[c]					110		3.6 / 0.10	0.3 / 0.00				PO_4 = 0.12 (Ortho)			70		30	DWR
5-11-66 1035	8	64	9.6	100	220	7.9						134		4.5 / 0.13	0.6 / 0.01				PO_4 = 0.04 (Ortho)					< 5 / 2	DWR
6-7-66 0910	5	65	9.6	102	260	7.6	2.04[c]					153		5.9 / 0.17	0.6 / 0.01				PO_4 = 0.02 (Ortho)			102		< 5 / 0.4	DWR
7-19-66 1250	1	82	8.6	107	280	7.6						171		5.4 / 0.15	0.6 / 0.01				PO_4 = 0.03 (Ortho)					< 5 / 0.3	DWR
8-16-66 0940	1/4	71	4.8	54.1	300	7.1						183		6.0 / 0.17	0.6 / 0.01				PO_4 = 0.07 (Ortho) Fe = 0.33 Mn = 0.01	164				< 5 / 0.1	DWR

a Sum of calcium and magnesium in epm

b Iron (Fe), manganese (Mn), total phosphate (PO_4), ortho phosphate (PO_4), color (C), ammonia (NH_3), sulfide (S), and apparent alkyl benzene sulfonate detergent (ABS)

c Gravimetric determination

d Hach turbidity in Jackson Turbidity Units using Hach Portable Engineers Laboratory, Hellige turbidity in A.P.H.A. Turbidity Units (ppm SiO_2) using Hellige Turbidimeter

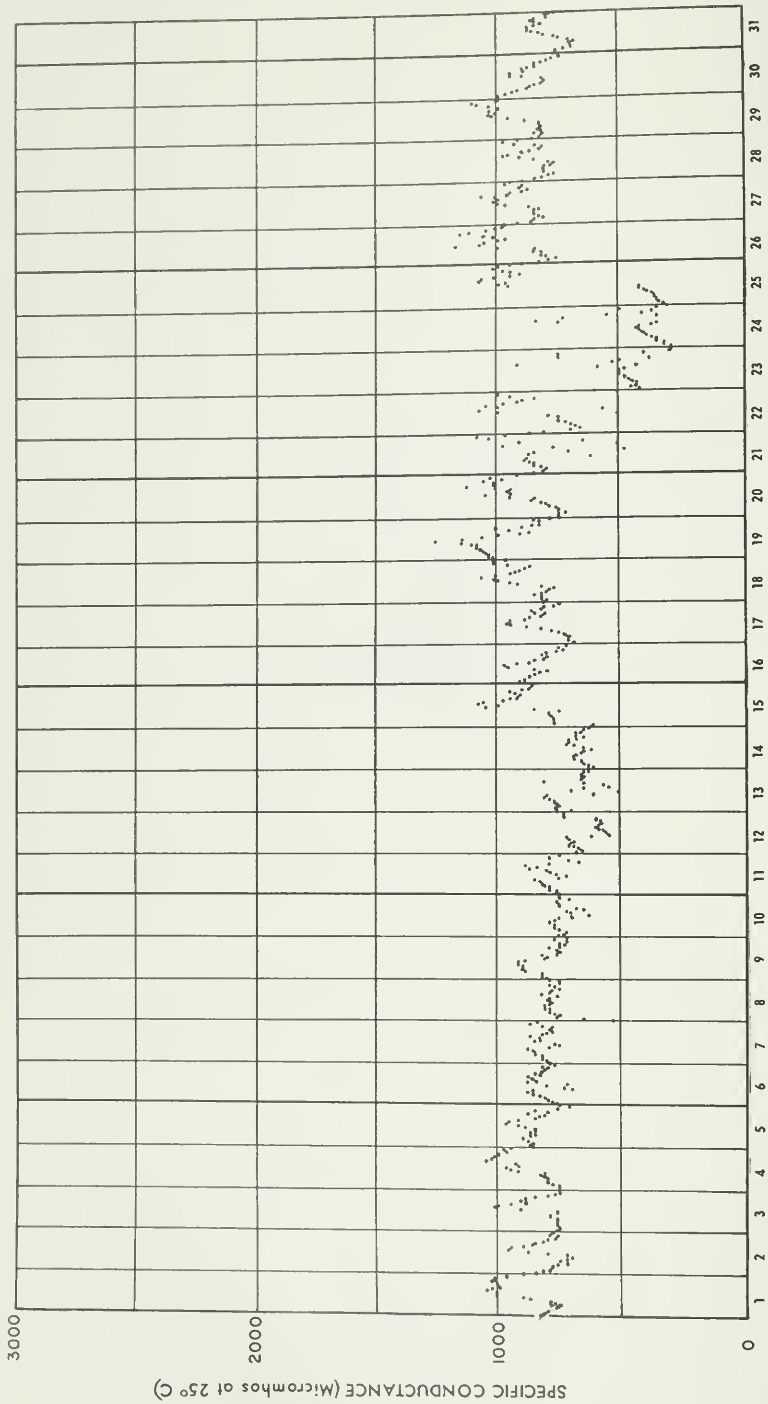
e Department of Water Resources (DWR), Pacific Gas and Electric Co. (PG&E), or United States Geological Survey, Quality of Water Branch (USGS)

Appendix D

SPECIFIC CONDUCTANCE

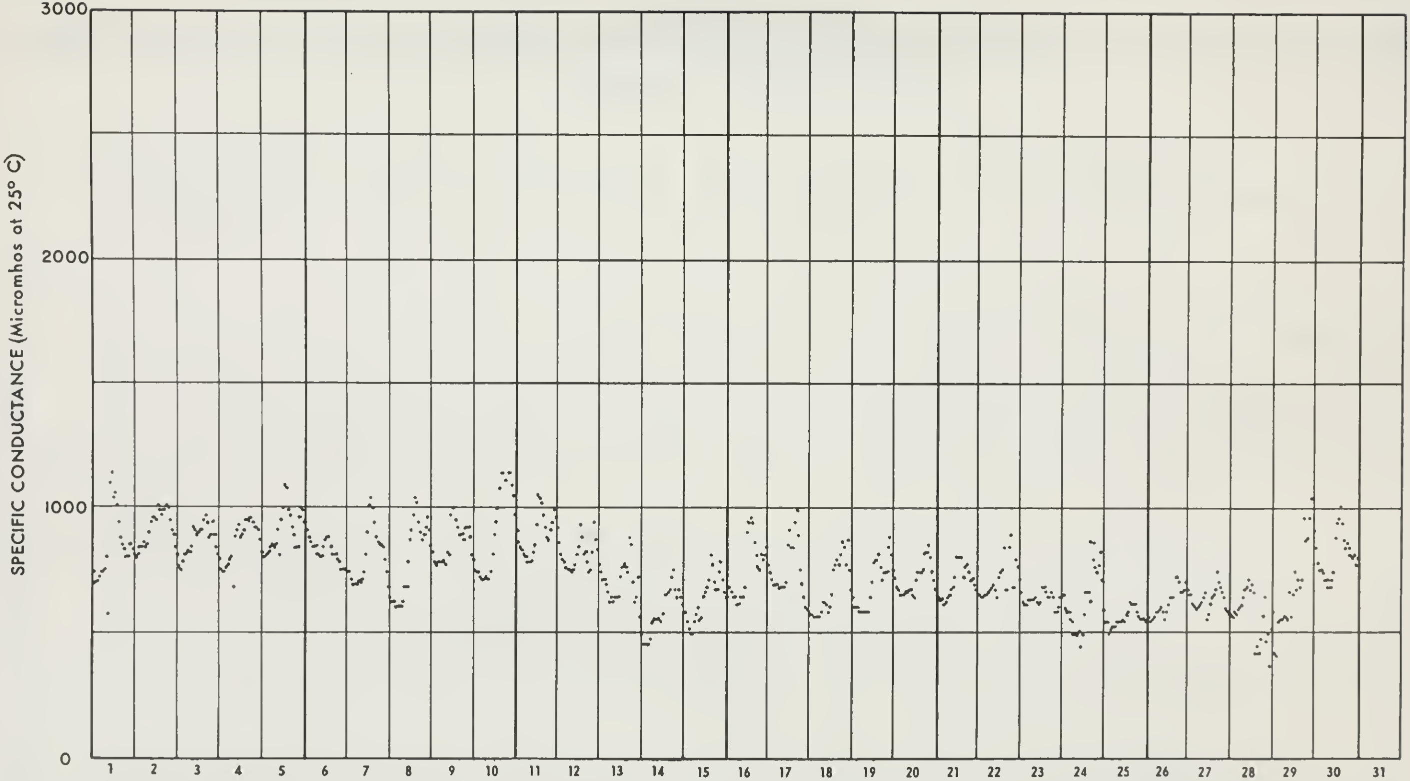
SANTA ROSA SEWAGE TREATMENT PLANT

FIGURE D1



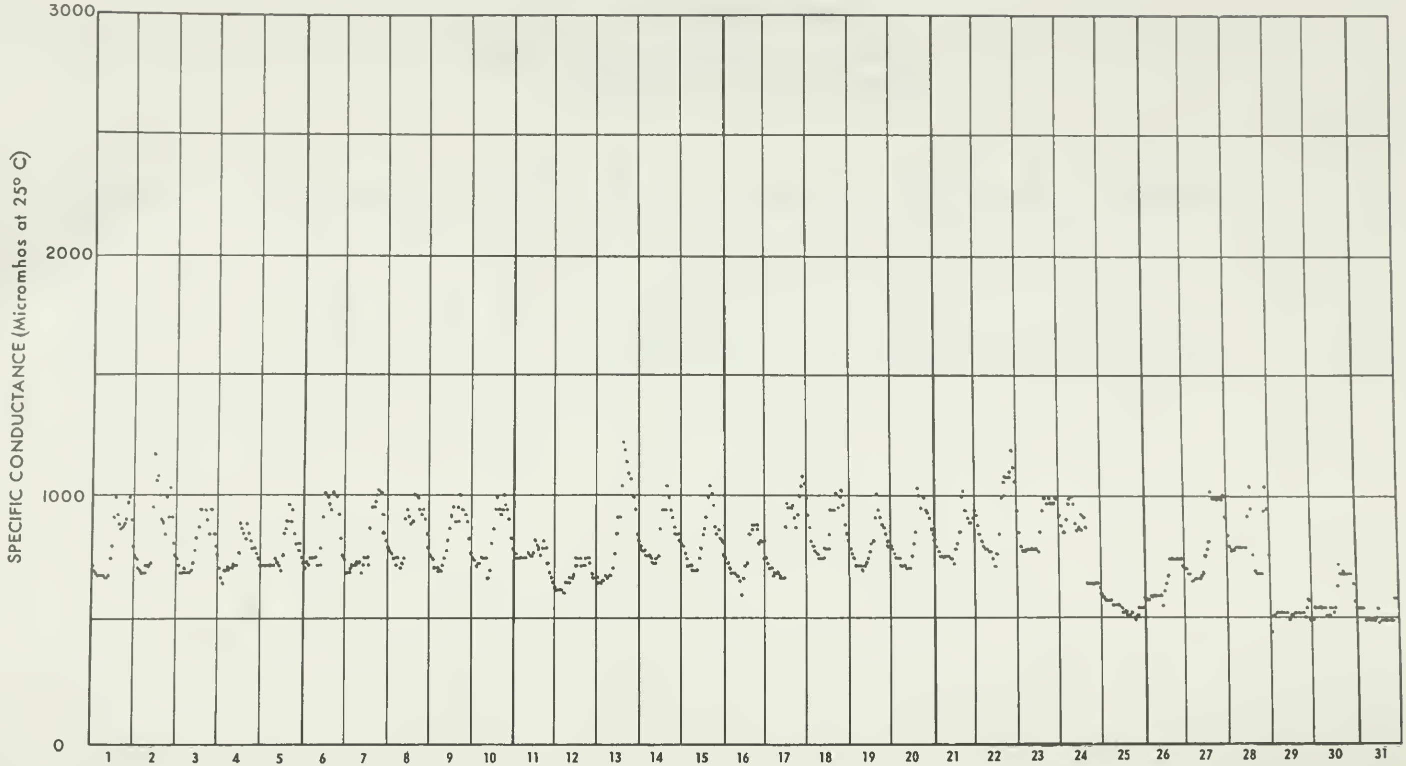
SPECIFIC CONDUCTANCE
SANTA ROSA SEWAGE TREATMENT PLANT
OCTOBER 1965

FIGURE D2



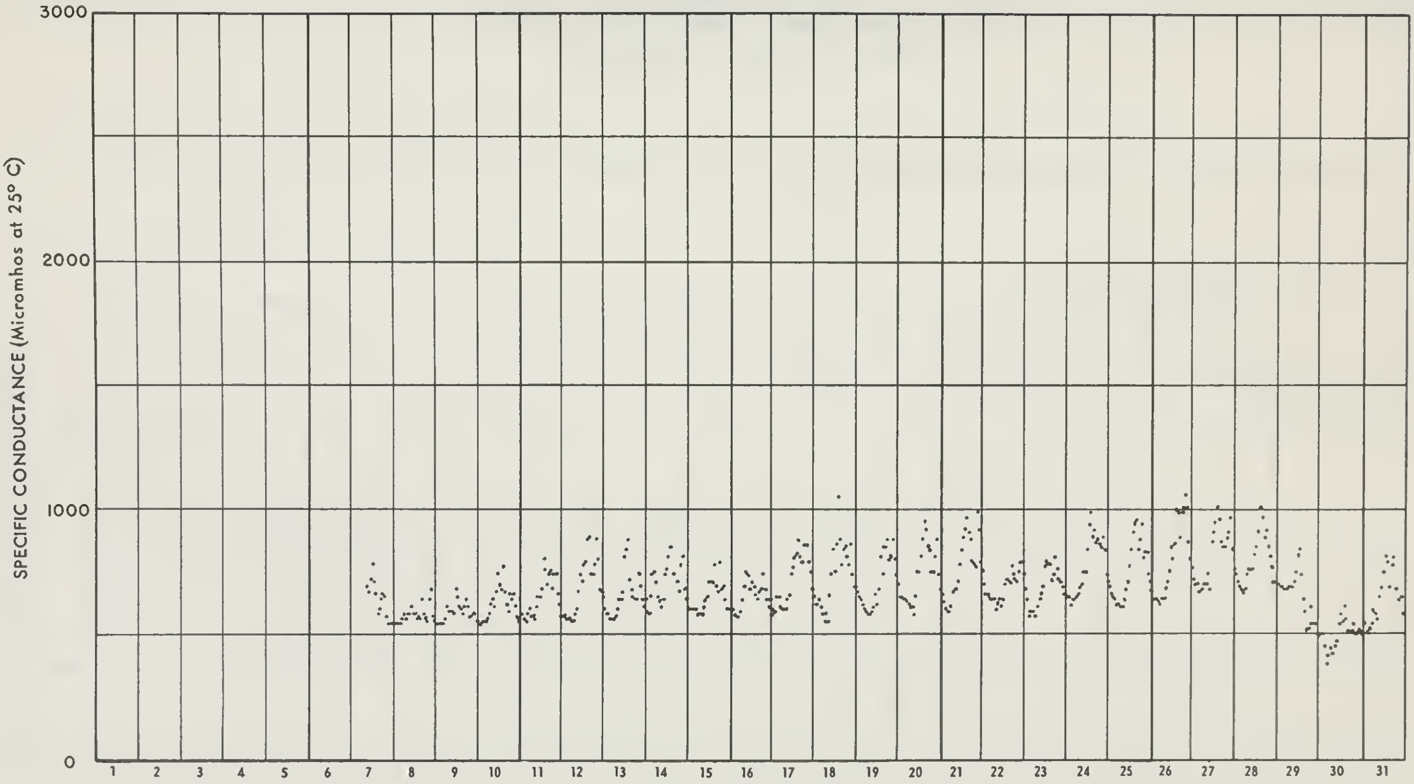
SPECIFIC CONDUCTANCE
SANTA ROSA SEWAGE TREATMENT PLANT
NOVEMBER 1965

FIGURE D3

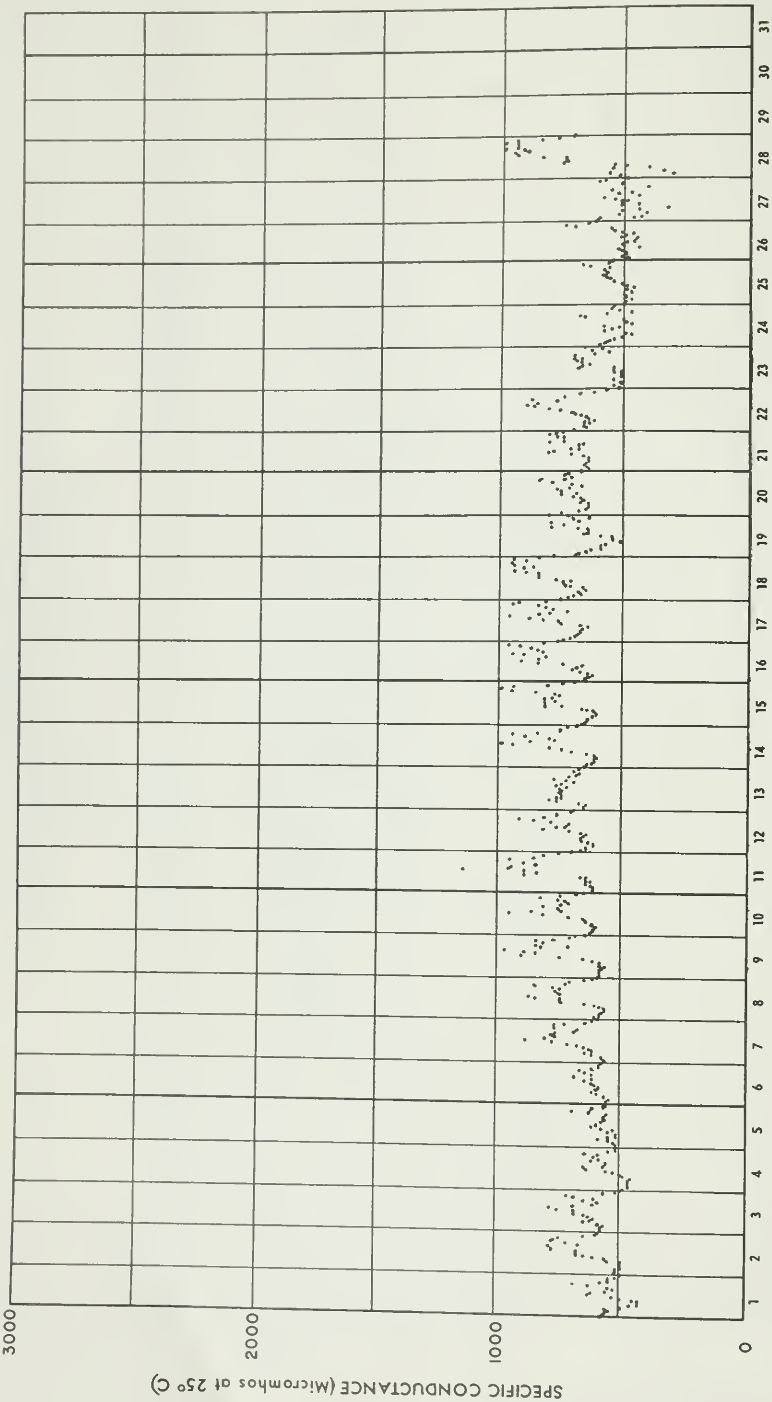


SPECIFIC CONDUCTANCE
SANTA ROSA SEWAGE TREATMENT PLANT
DECEMBER 1965

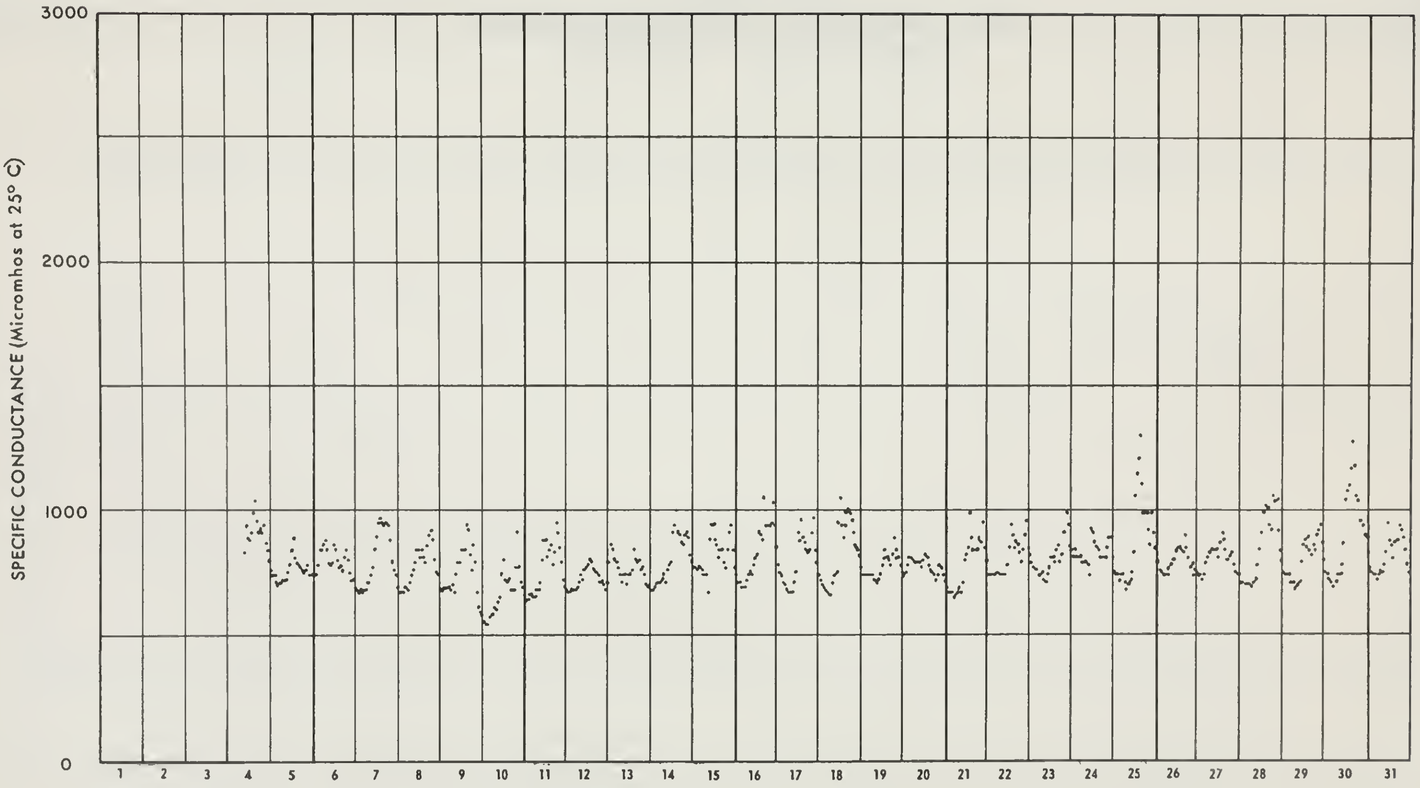
FIGURE D4



SPECIFIC CONDUCTANCE
SANTA ROSA SEWAGE TREATMENT PLANT
JANUARY 1966

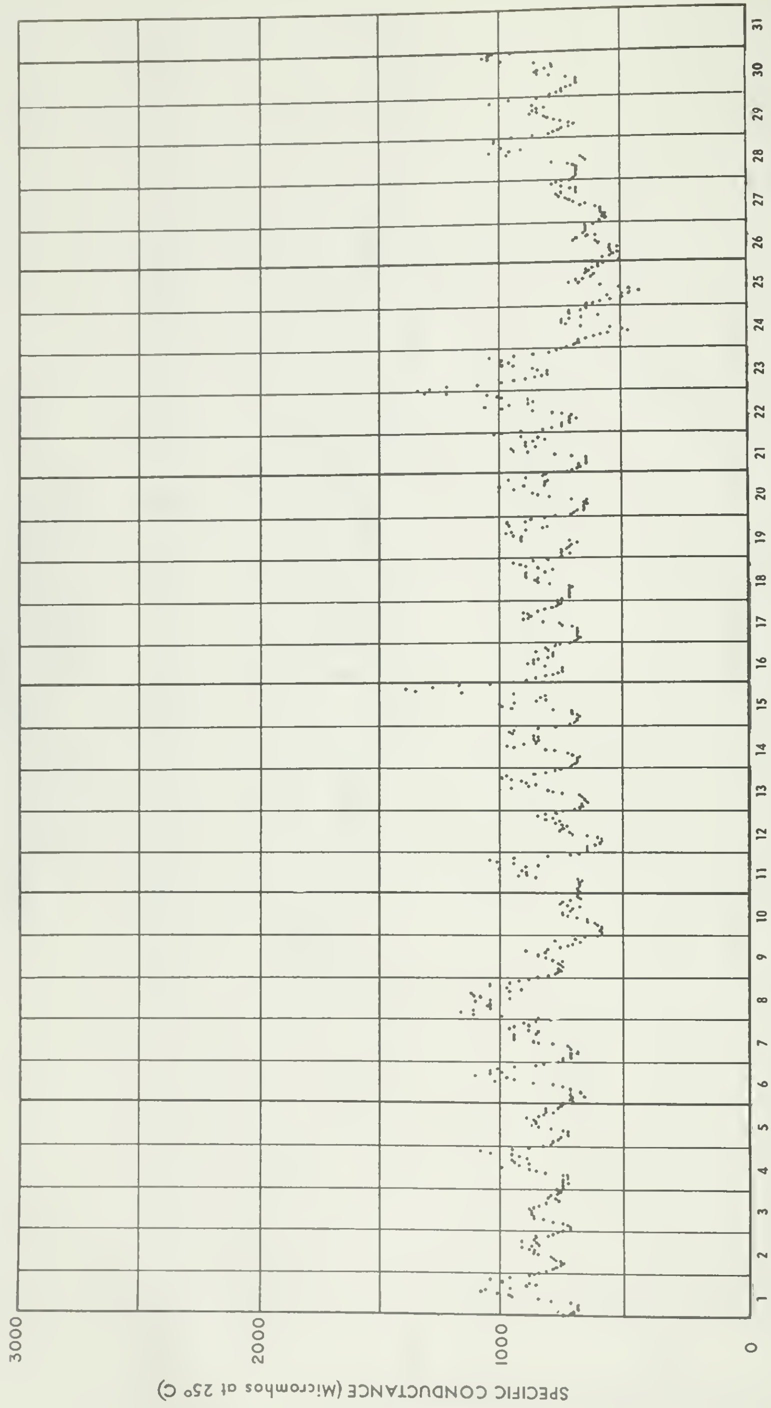


SPECIFIC CONDUCTANCE
SANTA ROSA SEWAGE TREATMENT PLANT
FEBRUARY 1966



SPECIFIC CONDUCTANCE
SANTA ROSA SEWAGE TREATMENT PLANT
MARCH 1966

FIGURE D7

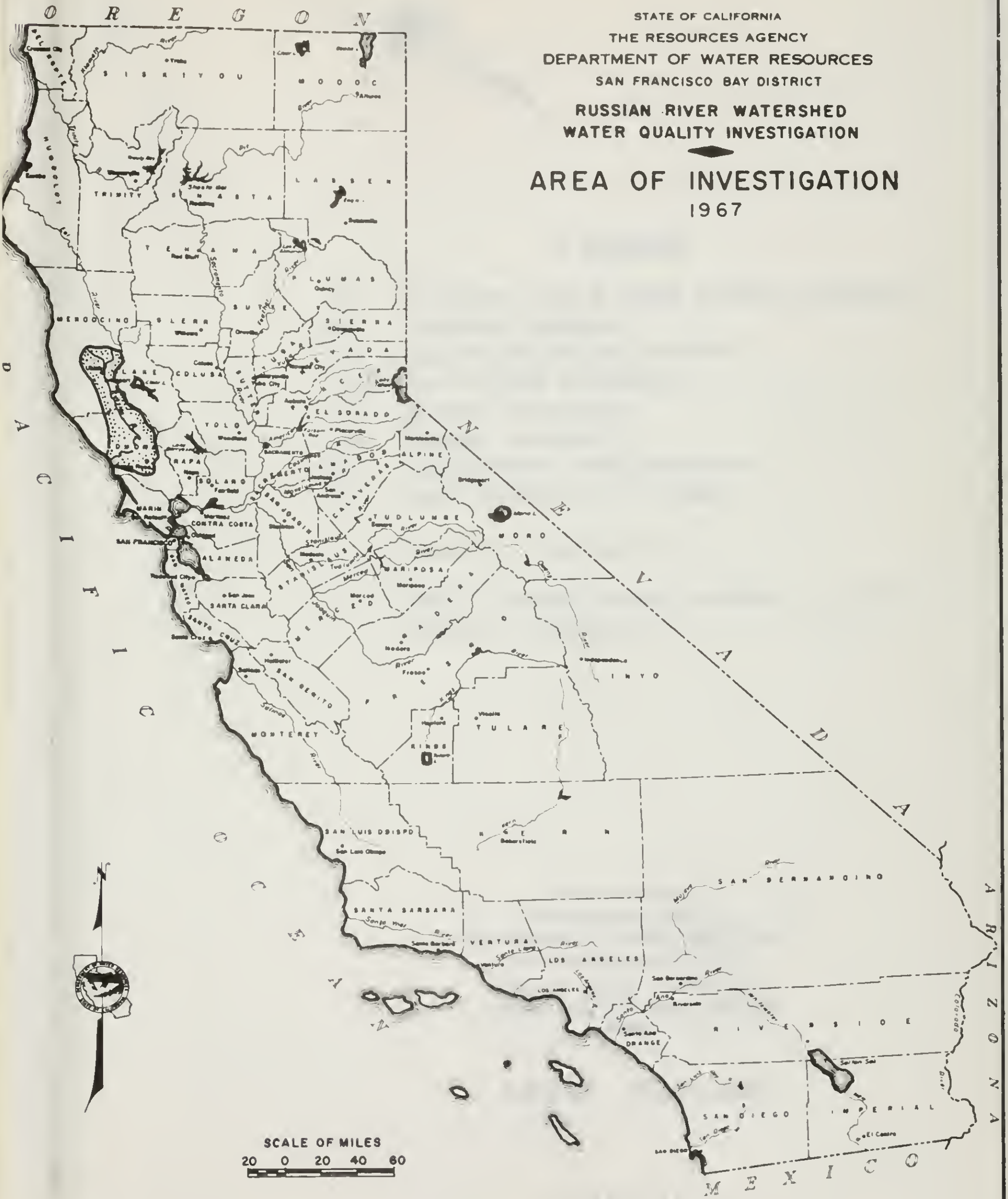


SPECIFIC CONDUCTANCE
SANTA ROSA SEWAGE TREATMENT PLANT
APRIL 1966

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
SAN FRANCISCO BAY DISTRICT

RUSSIAN RIVER WATERSHED
WATER QUALITY INVESTIGATION

AREA OF INVESTIGATION
1967



LEGEND

Qal	ALLUVIUM AND STREAM CHANNEL DEPOSITS
Qt	TERRACE DEPOSITS
TQc	PLIO-PLEISTOCENE DEPOSIT
TQge	GLEN ELLEN FORMATION
Tm	MERCED FORMATION
Tsv	SONOMA VOLCANICS
Kc	CRETACEOUS CONGLOMERATE
JK	JURA-CRETACEOUS ROCKS

GEOLOGIC CONTACT

FAULT, DASHED WHERE INFERRED, DOTTED WHERE CONCEALED

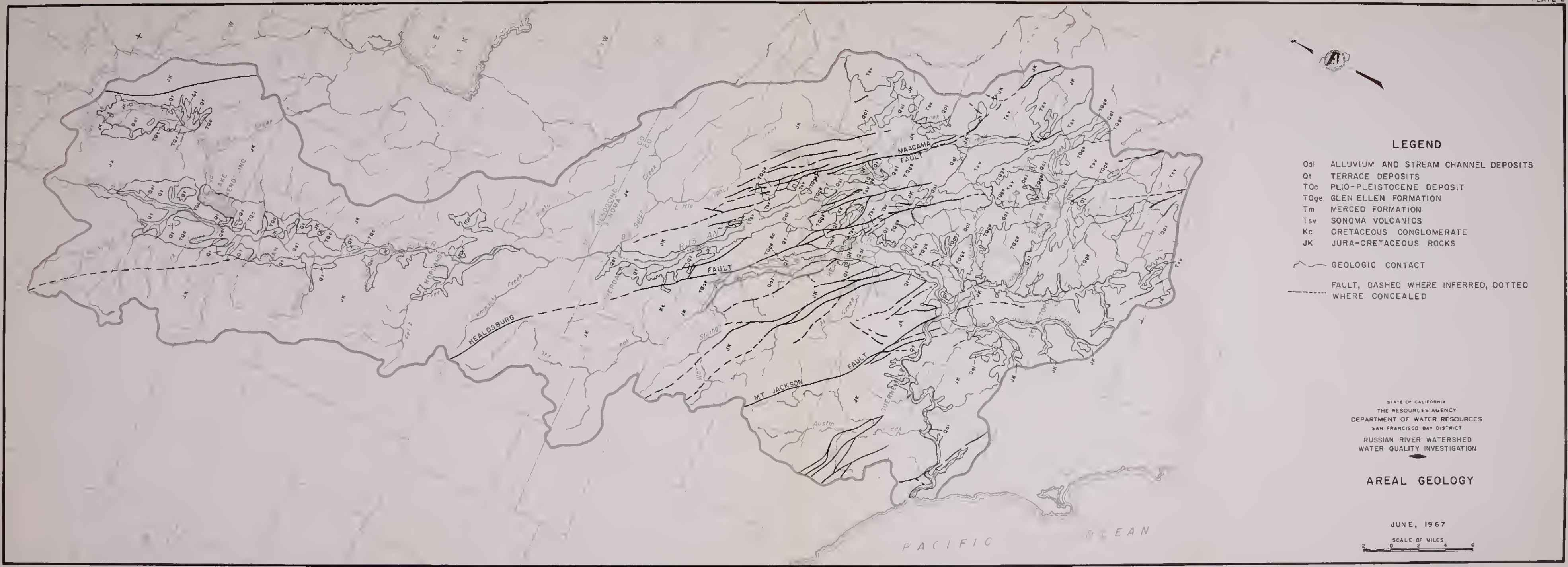
STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
SAN FRANCISCO BAY DISTRICT

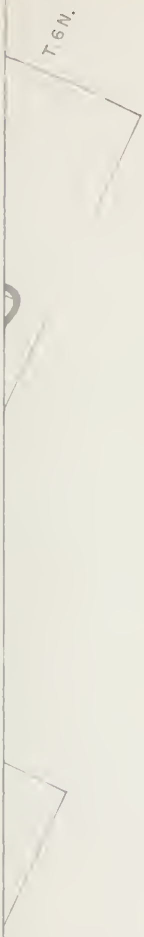
RUSSIAN RIVER WATERSHED
WATER QUALITY INVESTIGATION

AREAL GEOLOGY

JUNE, 1967

SCALE OF MILES
2 0 2 4 6


LEGEND
Qal ALLUVIUM AND STREAM CHANNEL DEPOSITS
Qt TERRACE DEPOSITS
TQc PLIO-PLEISTOCENE DEPOSIT
TQge GLEN ELLEN FORMATION
Tm MERCED FORMATION
Tsv SONOMA VOLCANICS
Kc CRETACEOUS CONGLOMERATE
JK JURA-CRETACEOUS ROCKS
GEOLOGIC CONTACT
FAULT, DASHED WHERE INFERRED, DOTTED WHERE CONCEALED
MAACAMA FAULT
HEALDSBURG FAULT
MT JACKSON FAULT
PACIFIC OCEAN
STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
SAN FRANCISCO BAY DISTRICT
RUSSIAN RIVER WATERSHED
WATER QUALITY INVESTIGATION
AREAL GEOLOGY
JUNE, 1967
SCALE OF MILES
2 0 2 4 6



LEGEND

▲ SURFACE WATER SAMPLING STATION

(2) HYDROGRAPHIC SUBUNIT

1. FORSYTHE CREEK
2. COYOTE VALLEY
3. UPPER RUSSIAN RIVER
4. DRY CREEK
5. SULPHUR CREEK
6. MIDDLE RUSSIAN RIVER
7. AUSTIN CREEK
8. LOWER RUSSIAN RIVER
9. MARK WEST
10. SANTA ROSA
11. LAGUNA

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
SAN FRANCISCO BAY DISTRICT

RUSSIAN RIVER WATERSHED
WATER QUALITY INVESTIGATION

HYDROGRAPHIC SUBUNITS AND SURFACE WATER SAMPLING POINTS

JUNE, 1967

SCALE OF MILES

2 0 2 4 6

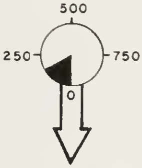
STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
SAN FRANCISCO BAY DISTRICT

RUSSIAN RIVER WATERSHED
WATER QUALITY INVESTIGATION

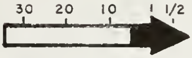
HYDROGRAPHIC SUBUNITS
AND
SURFACE WATER SAMPLING POINTS

JUNE, 1967

LEGEND



SHADED PORTION OF CIRCLE INDICATES ELECTRICAL CONDUCTIVITY IN MICROMHOS AT 25°c.



SHADED PORTION OF ARROW INDICATES FLOW IN CUBIC FEET PER SECOND

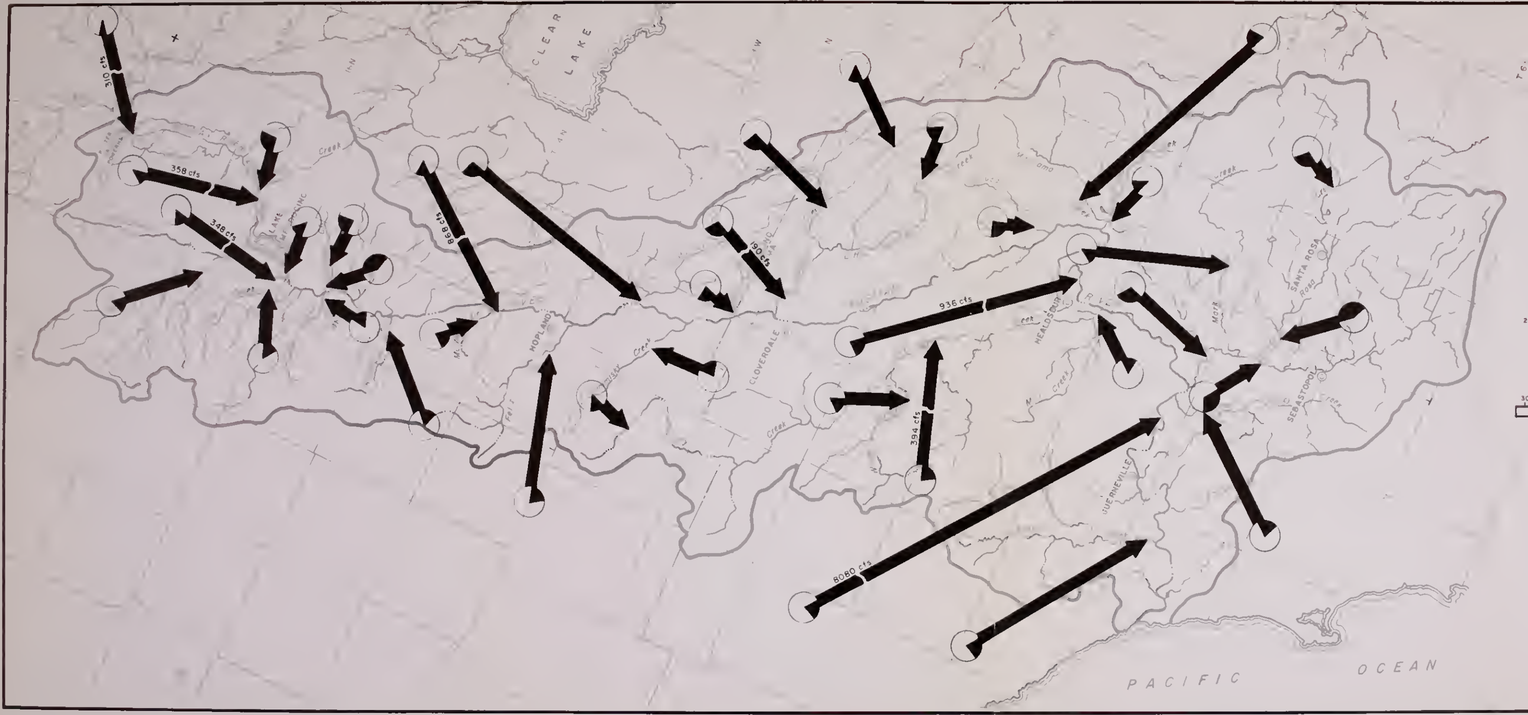
STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
SAN FRANCISCO BAY DISTRICT

RUSSIAN RIVER WATERSHED
WATER QUALITY INVESTIGATION

QUANTITY AND MINERAL QUALITY OF WET-WEATHER FLOW

JUNE, 1967

SCALE OF MILES



LEGEND

500
250
750

SHADED PORTION OF CIRCLE INDICATES ELECTRICAL CONDUCTIVITY IN MICROMHOS AT 25°c

30 20 10 1/2

SHADED PORTION OF ARROW INDICATES FLOW IN CUBIC FEET PER SECOND

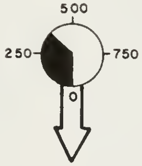
STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
SAN FRANCISCO BAY DISTRICT
RUSSIAN RIVER WATERSHED
WATER QUALITY INVESTIGATION

QUANTITY AND MINERAL QUALITY OF WET-WEATHER FLOW

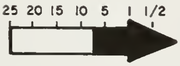
JUNE, 1967

SCALE OF MILES
2 0 2 4 6

LEGEND



SHADED PORTION OF CIRCLE INDICATES ELECTRICAL CONDUCTIVITY IN MICROMHOS AT 25°c



SHADED PORTION OF ARROW INDICATES FLOW IN CUBIC FEET PER SECOND

STATE OF CALIFORNIA
THE RESOURCES AGENCY
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SAN FRANCISCO BAY DISTRICT

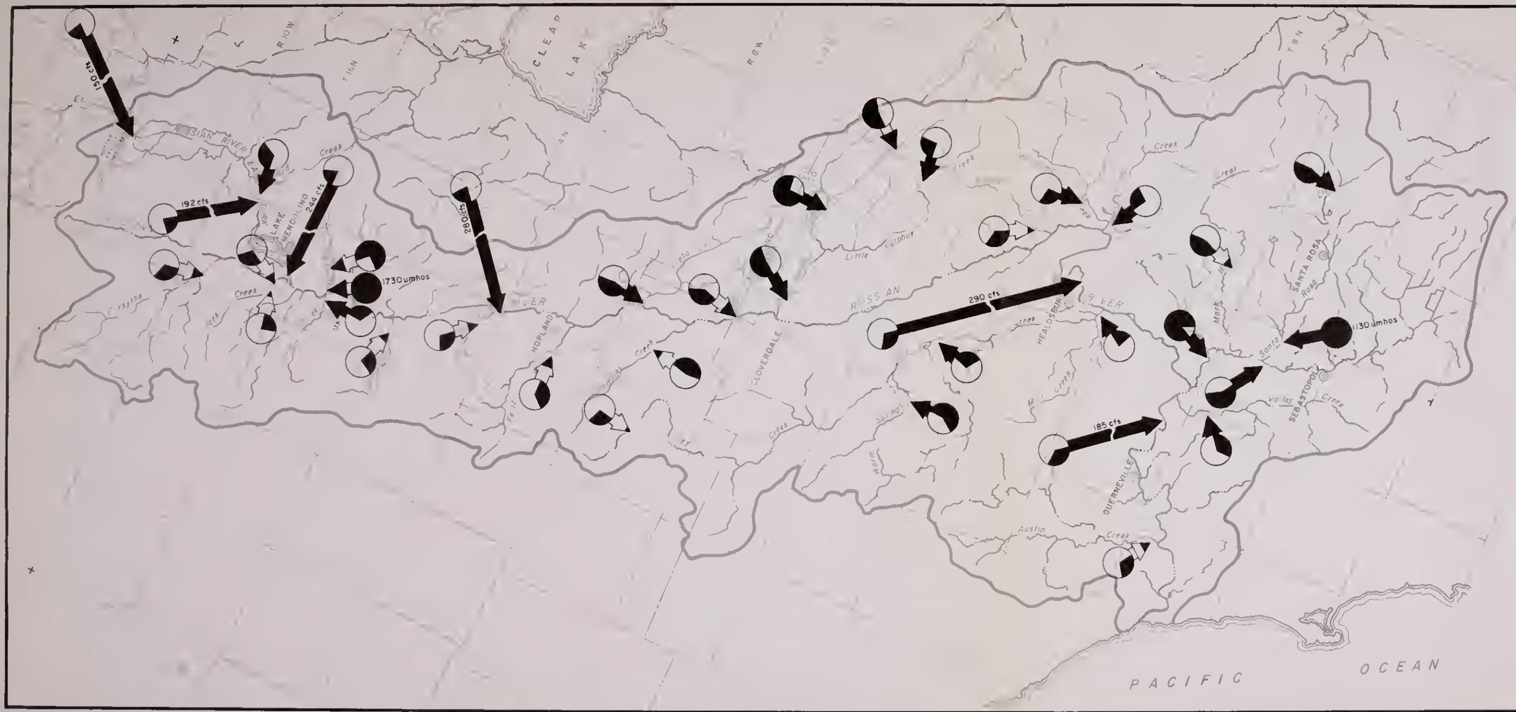
RUSSIAN RIVER WATERSHED
WATER QUALITY INVESTIGATION

QUANTITY AND MINERAL QUALITY OF DRY-WEATHER FLOW

JUNE, 1967

SCALE OF MILES

2 0 2 4 6



LEGEND

500
250
750
0

SHADED PORTION OF CIRCLE INDICATES ELECTRICAL CONDUCTIVITY IN MICROMHOS AT 25°c

25 20 15 10 5 1 1/2

SHADED PORTION OF ARROW INDICATES FLOW IN CUBIC FEET PER SECOND

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LEGEND

1-14.00 POTTER VALLEY GROUND WATER BASIN
1-15.00 UKIAH VALLEY GROUND WATER BASIN
1-16.00 HOPLAND VALLEY GROUND WATER BASIN
1-17.01 ALEXANDER VALLEY GROUND WATER BASIN
1-17.02 CLOVERDALE VALLEY GROUND WATER BASIN
1-18.01 SANTA ROSA GROUND WATER BASIN
1-18.02 HEALDSBURG AREA-SANTA ROSA GROUND WATER BASIN
1-18.03 RICON-KENWOOD GROUND WATER BASIN
1-19.00 Mc DOWELL VALLEY GROUND WATER BASIN
1-20.00 KNIGHTS VALLEY GROUND WATER BASIN
1-98.00 LOWER RUSSIAN RIVER GROUND WATER BASIN

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RUSSIAN RIVER WATERSHED
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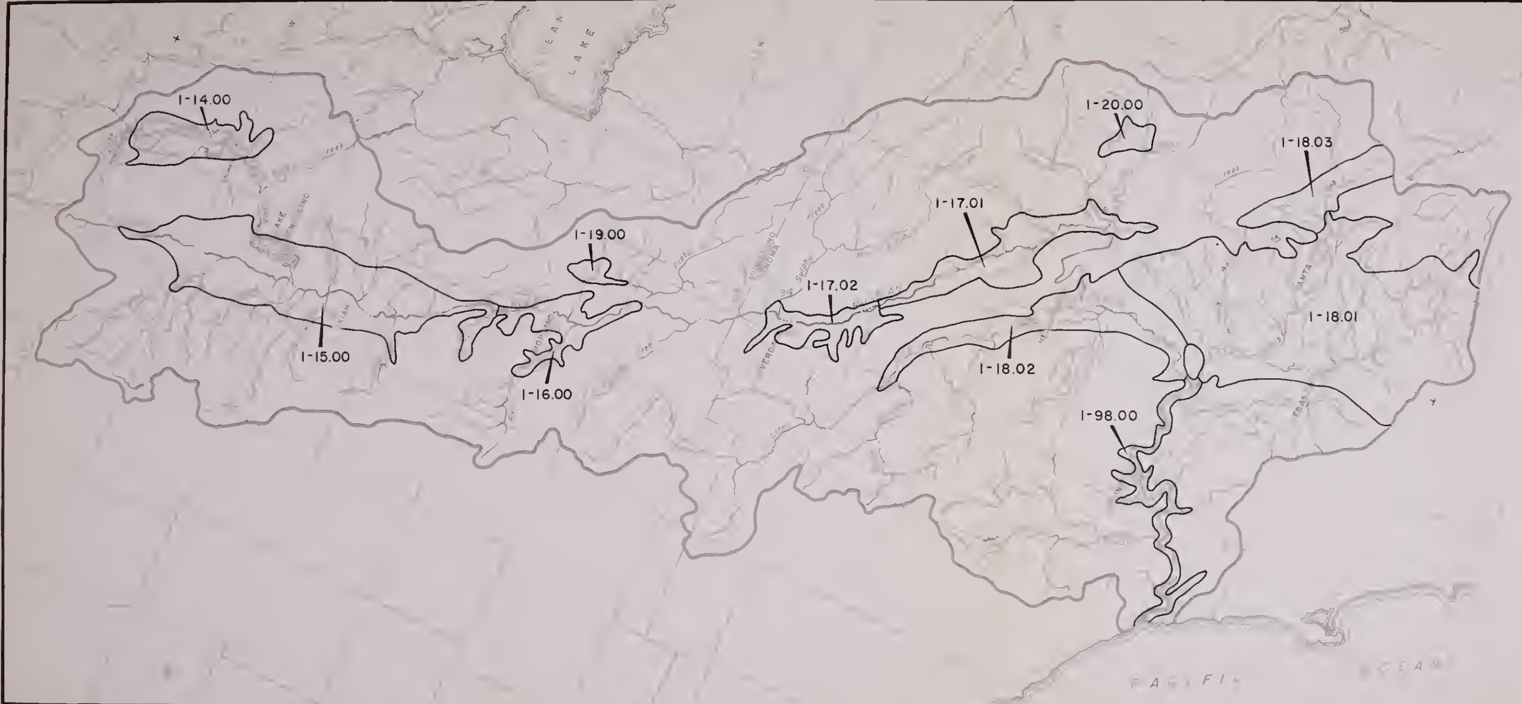
GROUND WATER BASINS

JUNE, 1967

SCALE OF MILES
2 0 2 4 6



LEGEND

1-14.00	POTTER VALLEY GROUND WATER BASIN
1-15.00	UKIAH VALLEY GROUND WATER BASIN
1-16.00	HOPLAND VALLEY GROUND WATER BASIN
1-17.01	ALEXANDER VALLEY GROUND WATER BASIN
1-17.02	CLOVERDALE VALLEY GROUND WATER BASIN
1-18.01	SANTA ROSA GROUND WATER BASIN
1-18.02	HEALDSBURG AREA-SANTA ROSA GROUND WATER BASIN
1-18.03	RICON-KENWOOD GROUND WATER BASIN
1-19.00	Mc DOWELL VALLEY GROUND WATER BASIN
1-20.00	KNIGHTS VALLEY GROUND WATER BASIN
1-98.00	LOWER RUSSIAN RIVER GROUND WATER BASIN

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WATER QUALITY INVESTIGATION

GROUND WATER BASINS

JUNE, 1967

SCALE OF MILES
2 0 2 4 6

LEGEND

▲ BORON CONCENTRATION 0.5 – 2.0 ppm

▲ BORON CONCENTRATION IN EXCESS OF 2.0 ppm

⇨ LOCATION OF SURFACE WATER SAMPLING STATIONS SHOWING BORON CONCENTRATION IN EXCESS OF 0.5 ppm

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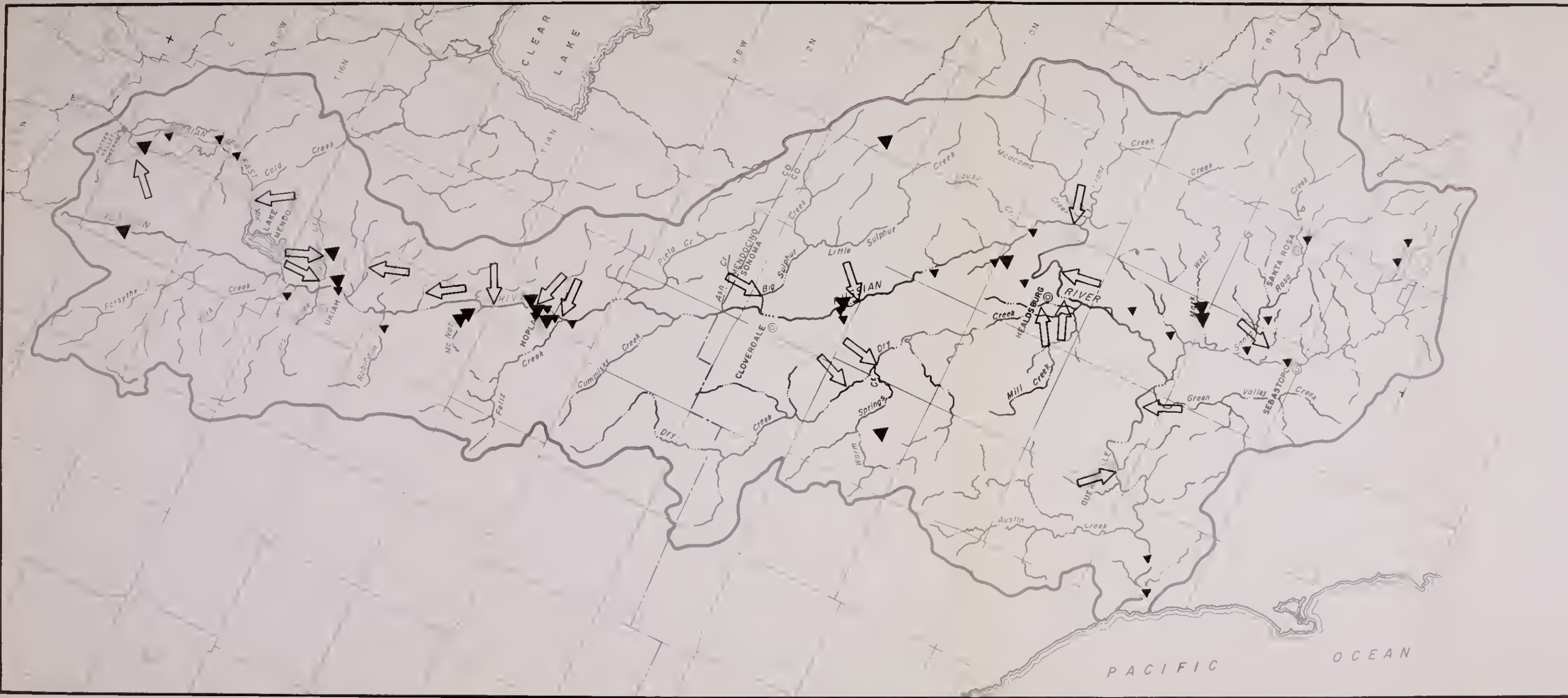
CONCENTRATION OF BORON IN GROUND WATER

JUNE, 1967

SCALE OF MILES

2 0 2 4 6



LEGEND

▲ BORON CONCENTRATION 0.5–2.0 ppm

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⇨ LOCATION OF SURFACE WATER SAMPLING STATIONS SHOWING BORON CONCENTRATION IN EXCESS OF 0.5 ppm

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